THE BARRIER-BELIEF APPROACH

A NEW PERSPECTIVE OF CHANGING BEHAVIOR IN PRIMARY CARE

ADRIE J. BOUMA

The research presented in this thesis has been conducted at the School of Sport Studies, Hanze University of Applied Sciences, Groningen, Department of Sports Medicine and Orthopedic Surgery, University Medical Center Groningen, Faculty of Behavioral and Society Sciences, University of Groningen, Center for Human Movement Sciences, University of Groningen, and Transcare, Transdisciplinary Pain Management Centre, Groningen.

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CHAPTER 1
GENERAL INTRODUCTION

Background

Chronic non-communicable diseases (NCDs) are reaching epidemic proportions worldwide[1-3]. NCDs are the main cause of global mortality, accounting for two-thirds of deaths[4,5]. In 2008, research showed that 36 million deaths (63% of all deaths globally) were linked to NCDs[6-10]. Alarming estimates suggested that NCD deaths will increase with 15% globally between 2010 and 2020[11]. These diseases, which include cardiovascular conditions (mainly heart disease and stroke), a number of malignant tumors, chronic respiratory conditions and type 2 diabetes, affect a substantial group of people in society.

NCDs are related to modifiable lifestyle risk behaviors[11]. The World Health Organization (WHO) recently indicated two lifestyle factors as leading risk factors for mortality: physical inactivity and unhealthy food habits[11-13]. People who are physically inactive have a 30% increased risk of all-cause mortality[14] and physical inactivity in the longer term is estimated to cause 6–10% of deaths from NCD[14,15]. Based on the physical activity recommendation, almost 60% of European adults are considered sufficiently active but more than 40% do not perform enough physical activity (PA) to attain the recommended levels[16]. About 30% of people with a disease[1] and 40% of the general population[2] are not motivated to engage in PA in the longer term[3]. When it comes to food habits, unhealthy food habits are strongly related to the increased incidence of NCDs and NCD-related mortality. Approximately 1.7 million (2.8%) deaths worldwide are attributable to low fruit and vegetable consumption[12].

To improve health and to prevent illness, it is important that people engage in PA and adopt a healthy diet[6-10,17,19-21]. In addition, lifestyle changes, such as a reduction of physical inactivity, have shown to cause a significant decrease of healthcare costs[22]. Moreover, people rate their own health more positive when their lifestyle pattern is healthier[18]. Thus, there is a widespread knowledge of the advantages of changing towards a balanced active lifestyle, and there are strong arguments for investing in a healthy lifestyle. Still, in Western societies a substantial group of the population is not sufficiently active and fails to meet the recommendations of a healthy diet[1,2]. Lifestyle counseling programs seem an appropriate intervention for lifestyle promotion[3]. In this thesis we will mainly focus on PA promotion.

Efficacy of PA interventions

Overall, it appears that lifestyle interventions can lead to significantly increased PA[3,4]. However, there are several issues that need to be resolved. Firstly, the efficacy of PA interventions is highly debatable[24,25]: Often their theoretical constructs are poorly described and the contribution of psychological constructs is rarely tested[28-31]. It is difficult to compare the efficacy of interventions because of the heterogeneity of the available interventions and the lack of long term follow-ups[19,32-34]. Secondly, many interventions have limited impact[23,26,27]. Meta-analyses indicate that a majority of individuals relapse to a less active or an inactive status when intervention-support is no longer provided[23,35]. Available research suggests that for sustainable behavioral change, future interventions should add behavior maintenance strategies, targeting the most influential factors of PA maintenance[36-39]. Thus, there is a need for a better understanding of the reasons for

inactivity, and the causes of relapse, and for developing theory-based behavior change strategies to stimulate and support maintenance of PA.

A psychological perspective on behavior

To understand the causes of PA behavior, we applied the Social Cognitive Theory (SCT)[40]. The SCT is one of the most widely-adopted theoretical frameworks on behavior. The SCT suggests that two variables will predict the intention to perform a behavior: *outcome expectations* and *self-efficacy expectations*[41]. Outcome expectations are defined as the beliefs about the occurrence of positive or negative effects of a specific behavior[42]. Self-efficacy expectations refers to people's own beliefs in their ability to perform a specific action that is required to attain an expected and desired outcome of their behavior. As people expect more positive outcomes of a behavior, and they feel more certain that they will be able to engage in the behavior successfully, they are more likely to develop an intention and remain firmly committed to their intention to engage in the specific behavior[44]; they are more motivated and more likely to continue to invest in behavior[45-48]. In line with Bandura's SCT, empirical data demonstrate that beliefs about capabilities and consequences are highly predictive of maintenance of PA[43].

In the present theorizing, the social cognitive factors are integrated in a higher level aggregate model in which motivation is needed to make the investment that is needed to engage in PA (Figure 1). Bandura postulated that negative self-efficacy related beliefs and negative outcome related beliefs play an important role in the *inhibition* of health behaviors[5]. In the present context, these beliefs determine the *investment needed* to perform PA: When a behavior is expected to have negative outcomes, and/or the self-efficacy is not optimal, much investment is needed to overcome these hurdles to engage in the behavior (with its desired and expected positive outcomes). The core question here is: "Is it worth investing in PA?", or "Will the investment in PA pay-off?" The answer to this question is determined by the expected positive outcomes of the behavior: When people expect important positive outcomes of PA, and they feel sufficiently certain that they will be able to engage in the behavior, they will be *motivated* to invest substantially. Thus, in our theorizing people weigh the investments needed and their motivation, to decide whether they will (continue to) engage in PA.

In this thesis the beliefs that comprise the investment, the negative outcome expectations and negative self-efficacy expectations, are called *barrier beliefs* (BBs). They represent the factors that need to be overcome to successfully engage in PA.

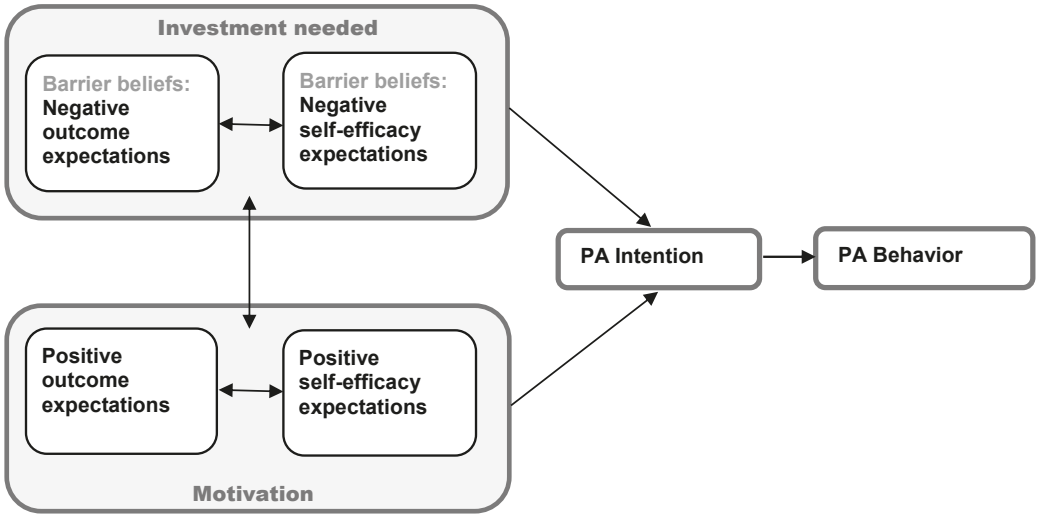

Figure 1. Self-efficacy beliefs and outcome expectations influencing PA intention and PA behavior based on the Social Cognitive Theory (Bandura, 1986).

Barriers and barrier beliefs (BBs)

BBs can be conceptualized as cognitions, beliefs, thoughts or verbalized experiences of a person that refer to factors that stand in the way of engaging in PA. In the present theorizing BBs are the main psychological factor that inhibits behavioral change; they are the psychological substrates that refer to barriers for PA. Several studies have described barriers related to PA, such as the weather, lack of time or joint pain, but a consistent theory is lacking. Barriers to PA are mostly treated as "fixed factors", as a separate factor or condition in addition to psychological factors that influence behavior. The present study takes the notion of barriers one step further by conceptualizing them as social cognitive determinants. When "barriers" are regarded as "barrier beliefs", they can be addressed in counseling interventions in more diverse ways. People can learn to identify and handle barrier beliefs that may inhibit a healthy lifestyle, to free their motivation to initiate or maintain PA. In this thesis we will study the functions and effects of BBs on PA and develop strategies for PA counseling to detect and cope with BBs.

Two additional general principles will be used in the counseling to support longer lasting effects: Firstly, according to our theoretical model people will engage in PA when their motivation exceeds the investments. This can be brought about in two ways: By increasing the motivation, or by lowering the investments. Because motivation is easy to increase but hard to maintain, the counseling will try to lower investment by addressing BBs. A stable intrinsic motivation can only be achieved by experience of the individual with PA. The second principle is that in the counseling people are not treated, but they will learn to engage self-management. Because BBs may change in function of external or internal changes, people will learn to handle (new) BBs themselves, so they are more independent of professional support.

Lifestyle interventions in primary care

In order to implement lifestyle interventions effectively, these interventions should be implemented in the primary healthcare setting. Primary care appears to be a suitable setting for the identification and reduction of behavioral risks, and for recommendation of preventive activities[52]. Two-thirds of a general population visit their general practitioner (GP) at least once a year and 90% at least once in every five years[53]. Health behavior can be addressed during everyday contacts with patients, family members, and other companions. Previous research stated that strategies to incorporate lifestyle interventions into primary care settings have been under-utilized[54]. The GP's task in prevention is not only to make an assessment of patients' health risks but also to refer patients to interventions where they will be coached in how to change their lifestyle[55].

GPs agree that they have a legitimate role to play in referral to lifestyle interventions[56], and yet the sobering reality is that GP referrals to lifestyle interventions are not part of "usual care" at this time[57-59]. Significant gaps between GPs' knowledge of their role in prevention and health promotion and their everyday practice were identified[55]. So far, several studies have addressed GPs' professional advice and patients' readiness to change[54,60,61], but few dealt with the GPs' motivation to refer to lifestyle interventions and patients' characteristics to refer on. Two studies about referral behavior to lifestyle interventions among GPs showed that GPs' implementation of lifestyle interventions was influenced by their own attitudes, social norms and control beliefs[62,63]. No statement was made about GPs' motivation to refer to lifestyle interventions, and both GP samples were small.

To bring an effective method to stimulate and support maintenance of PA in health care practice, GPs should be able to refer to a lifestyle intervention. For a better assessment and to enlarge the effectiveness of implementation of lifestyle interventions in primary care, a first step in this complex referral process is to determine GPs' motivation and decision-making to refer patients for lifestyle interventions.

Aim and outline

The aim of this thesis was to develop a theory-based counseling method to improve PA effectively in the longer term. We explored barrier beliefs (BBs) about PA and tested a barrier-belief counseling intervention (BBCI) in a primary care setting. To improve referral to lifestyle interventions, in order to enlarge the effectiveness of implementation in primary care, GPs´ referral behavior was investigated.

In **Chapter 2** a qualitative research was conducted to identify barriers inhibiting PA, during counseling, among inactive people. The aim of this study was twofold: to investigate which barriers were present related to PA in individuals (N=24) during the first phase of lifestyle counseling, and to construct a grounded theory to develop a clustered barrier model related to PA.

In **Chapter 3** a quantitative research was conducted to identify barrier to PA form a social cognitive perspective. The aim was twofold: to develop a theoretical framework of BBs about PA and to measure a difference in endorsement of BBs among active and inactive people. A

cross-sectional study was performed with a newly developed on line survey on BBs, intention, perceived pros and behavioral control and leisure time PA in active and inactive people (N=266, aged 18-80). The internal reliability and the validity of the BBs survey were analyzed.

In **Chapter 4** social cognitive theories and empirical evidence were evaluated for developing a theoretical framework and counseling strategies. The aim was to describe a cognitive theory on motivation and relapse in order to stimulate PA and prevent relapse, and to explain how different types of BBs play their role in increasing sustainable lifestyle changes. A set of cognitive and behavioral strategies was developed to handle BBs to PA in counseling.

In **Chapter 5** the effects of a BBCI were investigated on PA and fruit and vegetable intake of inactive adults within thirteen primary healthcare centers in the north of the Netherlands. A multicenter randomized controlled trial with a BBCI, a standardized lifestyle intervention (SLI) and a control group was conducted in inactive patients (N=240, aged 18-70). Intervention effects on PA, fruit and vegetable intake, and body composition were compared using multiple regression analyses at baseline, 6, 12 and 18 months.

In **Chapter 6** the effects of a BBCI on the endorsement of BBs and the impact of a change in BBs on PA and quality of life were investigated (N=240, aged 18-70). RCT data were used wherein a BB counseling intervention group and a SLI were compared in inactive primary care patients (N=240, aged 18-70). All measurements were followed-up at 6, 12 and 18 months. Intervention effects on different types of BBs were compared using multiple regression analyses. The impact of changes in BBs on changes in PA and quality of life were assessed by multilevel analyses.

In **Chapter 7** the motivation of GPs to refer to lifestyle interventions was explored and patient indicators in the decision-making process of referral to lifestyle interventions were investigated. To this end, a cross-sectional study was conducted among 99 Dutch primary care GPs.

The last chapter of this thesis includes a general discussion, conclusions and practical applications.

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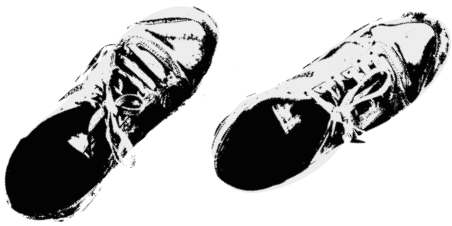
CHAPTER 2

BARRIERS RELATED TO PHYSICAL ACTIVITY IN HEALTHY ADULTS PARTICIPATING IN LIFESTYLE COUNSELING; A GROUNDED THEORY AFTER QUALITATIVE ANALYSES

Paul van Wilgen, Adrie J. Bouma, Arie Dijkstra

Submitted



ABSTRACT

Aim: To investigate which barriers related to their physical activity people experience during the first phase of lifestyle counseling, and to construct a grounded theory to develop a clustered barrier model related to physical activity. Several studies have described barriers related to physical activities although a grounded theory is lacking.

Method: A qualitative research was conducted to identify barriers inhibiting physical activity, during counseling, among inactive people (N=24). Counseling sessions were transcripted verbatim by two independent researchers open and axial coded and a grounded theory (GT) was executed. The found GT was tested by classifying existing barriers described in literature.

Results: A grounded theory with two categories of barriers related to PA was found: psychological barriers and concrete barriers. The psychological barriers contained six subcategories (motivational, knowledge, negative outcome, social support, aversive and psychological state) the concrete barriers contained seven subcategories (weather, physical, money, time, distance, social environment and equipment). The GT seems to fit the existing barriers described in literature.

Conclusion: A grounded theory of barriers related to physical activity was found with psychological and concrete barriers. This theory seemed useful for further research and for coaching practice to systematically explore barriers.

INTRODUCTION

Physical inactivity is a worldwide growing problem with one out of five adults being physically inactive[1]. Physical inactive increases the risk for chronic diseases, several cancers and obesity[2]. Engaging in physical activity can prevent for diseases and increase physical and mental well-being[3-5]. Therefore, public health interventions have been developed and implemented worldwide, aimed at increasing physical activity.

Currently a wealth of interventions targeting physical activity have been described in different settings and populations. The reported effect sizes of PA interventions are heterogenic, although there seems support for the efficacy of interventions in producing moderate, short-term improvements in PA[6-8]. When it comes to the maintenance of physical activity on the long term, there is a need for improvement[9,10]. Results of systematic reviews and meta-analyses of long-term effects of interventions indicate that, although during the interventions the adherence is high, the majority of individuals relapse to a less active or inactive status after the intervention[11,12]. One of the explanations is that motivation temporarily increases during the intervention but that the perceived barriers related to physical activities in daily life do not change[13]. These barriers become manifest after the intervention when motivation drops down to default levels. Interventions are most effective when they alter the underlying barriers that influence physical activity[14]. Therefore, counselors working in lifestyle interventions should discuss barriers in an early stage of goal setting; dealing with perceived barriers has more influence on physically activity than does enhancing perceived benefits of exercise[13].

The question arises, what a PA barrier is. Barriers are referred to in different health models like the Theory of Planning Behavior[15] (TPB) of Ajzen (1991) and the Social Cognitive Theory[16] (SCT) of Bandura (2001), and can be described as thoughts or verbalized experiences or estimates of a person about what is keeping him or her from starting or maintaining PA[17]. In recent literature, several studies have described barriers as important determinants related to levels of PA[18] although a sound theory of barriers related to PA is still missing.

Some studies developed questionnaires to measure barriers such as the Exercise Benefits and Barriers Scale (EBBS)[19]. This questionnaire was developed inductively after interviews and barriers were obtained from the literature. An overview of different barriers related to PA was presented in a study from Toscos et al., (2011). Barriers were gathered from the literature and from a qualitatively study using an online forum during a three-month healthy lifestyle intervention (Table 1). Several studies have been published presenting different barriers related to PA. For instance Booth, Bauman, Owen, & Gore, (1997)[20] described in a study of Australian individuals from 18-80 the following list of barriers related to physical activity: 'no time', 'no motivation', 'injury', 'not sporty', 'need rest', 'no company', 'children', 'poor health', 'lack persistence', 'no energy', 'can't afford', 'don't enjoy', 'no facilities', 'too old', 'fear injury', 'too fat', 'too shy' and 'no equipment'. In a Belgium study in three Population-Based Adult Samples the following barriers were presented; 'lack of interest', 'external obstacles', 'lack of time', 'embarrassment', 'psychological problems', and 'health barriers'[21]. In an study from the US among elderly 'lack

of interest', 'lack of self-discipline', 'self-consciousness', 'lack of company', 'lack of enjoyment', 'lack of knowledge', and 'lack of good health' where the barriers described[22]. A qualitative study among Latinas living in the U.S. provided three themes of barriers related to physical activity; 'individual barriers' (economic limitations, time constraints and lack of motivation), 'sociocultural barriers' (homelessness, crime, gangs, fear of immigration, Mexican cultural norms (e.g. gender roles, body size image)), and 'environmental barriers' (poor lighting, lack of sidewalks, speeding traffic, unleashed/unattended dogs and vandalism)[23].

Besides, from the study of Martinez et al., (2009) to our knowledge no grounded theory of barriers related to PA was presented. Therefore, to set up and develop a grounded theory, we conducted a qualitative research on existing barriers in clients during counseling. The aim of this qualitative study was twofold: to investigate which PA related barriers are presented by individuals during the first phase of lifestyle counseling, and to construct a grounded theory and model with categories and subcategories on PA barriers.

Table 1: Barriers (n = 33) from literature and a qualitative study classified in the outcome of our grounded theory.

Barriers by Toscos et al., 2011	Grounded Theory study
Illness	6
Poor health	6
Injury	3/6
Lack of willpower	1
Lack of motivation	1
Lack of time	5
Actual or anticipated change in body	6/3
Lack of resources	5
Lack of energy	3
Too tired	3
Lack of progress	3
Weather related barriers	5
Psychological barriers	7
Social Influence	4
Social interaction	4
Too boring	3
Lack of enjoyment/fun	3
Change in physical environment	8
Occupation	-
Get physical activity on the job	-
Fear of injury	3
Temporary change in environment	8
Physical barriers	6
Care-giving duties	5
Physical exertion	3/6
Exercise is tiring	3
Exercise is fatiguing	3
Exercise is hard work	1
Health concerns	3/6
Lack of interest	1
Lack of social support	4
Not the sporty type	1

METHOD

Participants

Participants in the study were clients in a lifestyle-counseling program. All clients were referred by their general practitioner or referred themselves after receiving an information letter from their general practitioner. All clients were 'inactive' according to the ACSM norm[24]. The clients were informed about the study by their counselor and were assured of confidentiality before the start of the sessions. The clients were all adults (> 17 years) and voluntarily participating in the lifestyle counseling program. Exclusion criteria were not speaking the Dutch language, and not willing to participate in the study.

Design

To investigate the barriers related to life style change, a qualitative exploratory design was used based on the methods of grounded theory (GT). GT was used to develop a categorical barrier model related to PA[25]. The participating counselors were asked to audiotape their first two sessions (after the intake) with their clients. The barriers were investigated afterwards.

Procedure

The counselors were participating in a life style counseling study. The counseling took place in the primary care general practitioners' offices in the northern part of the Netherlands. The counselors all followed an eight weeks counseling course (16 sessions) followed by weekly peer group sessions. They were students of the school of physical activity & lifestyle, the school of applied psychology of the Hanze University of applied sciences in Groningen or the Department of psychology at the University of Groningen. The sessions were recorded by digital audio recording equipment. The audio recordings as a whole were transcripted verbatim by four researchers. The questions of the counselors and the responses of the clients were described separately. The Human Research Ethics Committee of the University Hospital of Groningen approved the study and written informed consent was obtained prior to testing.

Analysis

The transcripts were read by two observers (AB and PvW). Before the study, the observers were trained by indexing several assessments from patients, other than those participating in the present study. The transcripts were then analyzed using an open coding indexing technique to identify phrases in which barriers were identified. Both started separately with close readings of the transcripts of 12 clients. After open coding of the transcripts of 12 clients, a discussion and comparison of the coding was performed and categories and subcategories were defined. Any differences in the initial indexing process between researchers were resolved by discussion. Two focus groups were organised to discuss the found barriers, categories and subcategories; one with four counsellors and one with experts on barriers. After this, another 12 interviews of clients were coded axial by the same two researchers. Aim was to integrate and refine

the categories and subcategories in order to obtain a sutured theory. Again, discussion and comparison between the researchers and about new categories or subcategories were discussed until consensus was reached. After the coding of 12 more transcripts no more meaningful information or new barriers was gained, indicating theoretical saturation.

The fit of the found grounded theory with categories and sub-categories was tested on the barriers described by Toscos et al., (2011). Three observers independently classified the barriers; discrepancies were discussed until consensus was reached.

RESULTS

Transcripts of 24 clients were included and coded anonymously in two phases. The data after 12 clients revealed seven categories; motivational factors, lack of knowledge, negative outcome expectancies, social factors, investment factors, physical state, physical environmental factors (Table 2). After axial coding of another 12 clients, the category 'psychological state' was added as a category, and two sub-categories were added (social environment and equipment). Barriers represent the factors that need to be overcome to successfully engage in PA.

Motivational factors

Barriers on motivation are quotes showing that engaging in PA isn't important to the person, is not what he / she wants or is too difficult. Some motivational barriers can be seen as 'excuse' not to become physical active; "*Yeah what keeps me from doing it, I think it is me, just doing it…. making the first step*", or "*I just don't have the motivation",* or *"My God, I think I am the biggest barrier myself it is just laziness",* or *"I make up excuses all the time".* Some of the prioritizing barriers can be related to a lack of persistence *"I do not have the persistence to continue a PA program".*

Lack of knowledge

A barrier can be related to missing the right knowledge how to start with PA or inadequate knowledge about physical activity in general. A quote related to not knowing how to start was "*I really don't know how I should get started, I am serious".* Barriers related to not being aware of the benefits of PA often in clients with physical symptoms; "*That keeps me from doing it [physical activities] I think it is not good for my overuse injury" or "I think this [PA] will worsen the state of my heart, I had a heart attack as you know".*

Negative outcome expectancies

Barriers can be related to perceived or expected negative outcomes of PA, disappointing results or negative feelings. Some clients perceive negative outcomes during PA leading to the construction of barriers. Others do not start a PA program because of expected negative outcomes. These expectations can be caused by negative experiences in the past.

Table 2: Main categories and subcategories of barriers beliefs related to physical activity

	Categories
1	**Motivational factors** -excuses -lack of persistence
2	**Lack of knowledge** -how to start -not aware of benefits or inadequate perceptions symptoms (e.g. pain)
3	**Negative outcome expectancies:** -negative outcomes of the new behavior (related to symptoms: sweat, pain, fatigue, short of breath) -disappointing results (not feeling better after PA, not losing weight, no progress) -negative feelings about the new behavior (not enjoying it, boring, fear, shame)
4	**Social factors** -missing -inadequate social support
5	**Investment factors** -weather (too cold, wet, warm (asthma), slippery) -money -time (being too busy related to a specific moment, not able to make time, stressful situations)
6	**Physical state** -overweight -illness -injury -physical condition -age
7	**Psychological state** -feeling depressed -feeling stressed -low self confidence
8	**Physical environmental factors** -distance -no adequate place to exercise -equipment

Barriers concerning '*negative outcomes of the new behavior*' refer to negative experiences or results caused by PA behavior. They can be related to several symptoms, such as: "*By being active I will get overheated and start sweating I don't like that".* In addition, physical symptoms, such as pain and fatigue, were often mentioned barrier e.g. *"I had three operations, it is an overuse injury, pain keeps me from being active"* or *"When I come home, I am just too tired, exercising makes me only more tired".*

Barriers about '*disappointing results*', which refer to a non-correspondence between the experienced outcomes of PA with the expected outcomes of PA, yielding a deficient reward of effort*:* Barriers can be related to the expectation of not losing weight by being more PA*; "Being physical active is not for me, I won't lose weight anyhow"* or not seeing enough progress during a PA program.

Barriers related to '*negative feelings about the new behavior*' refer to aversive emotions caused by performing PA. A frequent mentioned barrier was to not enjoying PA "*Half an hour on a treadmill? I just don't like it" or "I don't go for a walk it is just no fun, I really don't".* Also, aversive

barriers to PA are often related to shame or fear e.g., *"Lots of thing are holding me back from being active, if I go somewhere people will think what is she doing here…you know what I mean"* or *"With this body I just cannot go to a swimming pool"*. Moreover, the fear is often related to illnesses *"I suffer from arthrosis in my knee, so I have to be very careful with everything I do"* or related to the situation *"I am afraid to go out alone at night when it's dark"*.

Social factors

Social barriers to PA refer to a perceived deficiency in social support, or presence of social discouragement in performing PA. They are expressed as not having a partner to go with *"I don't like to go by myself, I miss the social part"*, or *"I think if I had a partner to go with I would do it"*, or as a lack in social support during PA :*"I expected more coaching and support during the training, I had to do it all by myself"*, or *"Two other women in the village are also walking but they are just too fast I cannot keep up with them"*.

Investment factors

When the investment needed (money, time or to handle the weather) to perform PA was experienced as being too high, this was experienced as a barrier. Handling the weather, was a barrier, mentioned specifically as *'rain', 'snow'* or *'cold'*. Also, participants mentioned the *'season'* e.g.: *"When it is winter and it is slippery I don't go out biking, I might fall and break my wrist"*, or *"When it raining cats and dogs like yesterday I don't go out for a walk"*. Also, '*heat*' in relation to for instance asthma, can be a barrier. Money was mentioned as a barrier concerting PA or sports, frequently mentioned related to fitness e.g. "*I mean the gym costs me about 50 euro a week, I think that's a lot of money'* or *'it [the gym] is too expensive"*. Time or being too busy is a frequently coded barrier. Often mentioned just as "*I don't have the time"* or "*Being physical active will take a whole morning; I have to pick up my son from school"*, or related to a specific moment *"That day did not fit in my schedule I had other appointments on Wednesd*ay", or "*December is a very busy month"*. Time can also be related to not being able to make time *"Everything has to be finished before I can make time for myself"*. Not having time can be related to stressful situations making the barriers more complex *"I have to do a lot of things, being physical active would make it more busy, I also do a study……it is difficult these stressful periods"*.

Physical state

General health problems were often mentioned as barriers. These barriers can be related to overweight, injuries, a bad physical condition or to age; "*I am too obese, I cannot be active with this body" or "I am just too old for all that physical activity"*.

Psychological state

The costs of coping with an aversive feelings were also experienced as barriers to engage in PA, such as: 'being stressed' or 'feeling depressed', e.g.: *"When I am too busy because of this whole situation in the last period and I also have to do this [activities] ppffff that's it is just too much"*,

or "When I feel stressed, when it is all just too complicated, than I find it [PA] just too difficult", or "*After my dad died, it all went wrong I gained a lot of weight, I just did not felt like doing it, I was tired".*

Physical environmental factors

The inaccessibility of facilities or counteracting conditions of the surrounding environment in performing PA may cause barriers. We distinguished: *Distance*; this barrier is often related to a sports facility, "*We live outside the village and if you don't really enjoy sport then the distance is a barrier". Environment*; the social environment itself can be a barrier to become more active such as "*In our neighborhood we don't have sport facilities*" or "*We live in a very crowded neighborhood*". *Equipment*; a concrete barrier is equipment needed for PA or sports mostly no equipment or missing the proper equipment *"I get back pain walking with these shoes, so my shoes are the problem not me, I need new shoes".*

DISCUSSION

After analyzing 24 transcripts of clients during PA counseling we eight categories of barriers related to PA: motivational factors, lack of knowledge, negative outcome expectations, social factors, investment factors, physical state, psychological state and physical environmental factors.

To 'test' our GT we analyzed the barriers described in an earlier study of Toscos et al., (2011). This recent study presents a long list of PA barriers from literature and of conducted qualitative analyses. The overall agreement between our GT and the barriers described was high, although 'occupation' and 'get physical activity on the job' were not classified barriers in our GT. If more information was available, these two barriers related to work, might be classified as 'time' or 'motivational' barrier. In our GT we found the barriers knowledge, psychological state, physical environmental factors which were not listed in the study of Toscos et al. Especially knowledge or inadequate illness perceptions about symptoms seem important barriers in our patient population to recognize, since in counseling and in health care practice education and giving information are important ingredients. Psychological state also seems an important barrier, the strength of our study was that personal counseling sessions were conducted, in the conversations clients often talked about their psychological state and that for instance their depressive feelings were an important psychological barrier or a reason for relapse. Toscos et al., (2011) used an online forum in their study; this might explain why psychological state was not recognized as a separate barrier.

Our GT also seems to fit the barriers presented in the studies described in the introduction[22]. The three categories of barriers, after qualitative analysis by Martinez et al. (2009)[23]: individual barriers, sociocultural barriers and environmental barriers, seem only partly overlapping with our GT. The sociocultural barriers i.e. the Mexican cultural norms differ and were not found

in our GT[23]. Probably every culture has specific barriers such as religious barriers or social-cultural barriers, which counselors should take into account during counseling.

Classifying the different categories and subcategories described in this study was sometimes arbitrary. Underlying constructs are sometimes overlapping e.g. suffering from an illness (physical state) or perceiving symptoms like being fatigued or pain related to PA (negative outcome expectancies). Symptoms such as pain and fatigue are often seen as physical barrier related to an illness. In this study, however we identified them as beliefs since the perception of these symptoms and the mental construction of a barrier related to these symptoms is mainly a psychological process. In clinical practice, however, the main goal is not to allocate a barrier to the right category but more important to recognize a barrier related to PA.

For clinicians working in counseling our GT can be useful. Discussing barriers already in an early stage during goal setting could prevent individuals for relapse when motivation drops. For instance still many clients who want to become more active choose to go to the fitness, while a lot of them don't enjoy it, find it expensive or have no time to visit a fitness several times a week. It is well know that the majority of people who start fitness will relapse within a few months. Counselors exploring and discussing barriers on forehand can help clients to choose other goals with a higher chance of maintenance. In clinical practice, discussing barriers is for many counselors a new strategy, since it is not common when someone is motivated to become more active, to start discussing specific barriers related to this goal. This undermining of motivation however might have better results on the long term. Many interventions use the Trans Theoretical Model to investigate the process of behavior change and the motivation to stay active[26]. As described in the introduction barriers become manifest after the intervention when motivation drops down to default levels. Although we did not specifically investigated this, specific barriers could play and important role in the relapse from an active phase to a (pre) contemplators phase. Further research is warranted to focus on this specific issue.

Strength of the study was that we analyzed more than 36 hours of recorded material of 'real life' counseling sessions in which barriers were analyzed. In addition, the construction of a GT is a strength of this study. Weakness was that the scripts were anonymously so differences in gender of age could not be analyzed. Another weakness was that we recorded two sessions at the beginning of the counseling program. Therefore we did not identify barriers perceived after several counseling sessions, these might have been different form the barriers at the start of counseling. Furthermore, in the introduction, we did not review all existing barriers on PA but we used some recent papers describing barriers and used an extensive one to compare our GT.

Conclusion

In this study, a grounded theory (GT) is presented for barriers in relation to physical activity. The GT can be useful during counseling to explore barriers of clients who want to change and maintain an active lifestyle.

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CHAPTER 3

BARRIER BELIEFS ABOUT PHYSICAL ACTIVITY IN ACTIVE AND INACTIVE ADULTS FROM A SOCIAL COGNITIVE PERSPECTIVE; AN EXPLORATIVE STUDY

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Submitted

ABSTRACT

Aim: To develop a theory based measurement of barrier beliefs on physical activity and to explore endorsed barrier beliefs in active and inactive people. Additionally, a difference in endorsement of barrier beliefs between active and inactive people was measured.

Methods: A cross-sectional study was performed with an online survey in 266 adults (aged 18-80) to identify barrier beliefs (barrier-beliefs questionnaire), intention, perceived pros and behavioral control (self-reports) and leisure time physical activity (SQUASH questionnaire). The internal reliability of the barrier-beliefs survey was analyzed using a Cronbach's Alpha. Validity was tested by a Pearson correlation ($p < .05$) and a multilevel regression analysis ($p < .05$). A difference in endorsement of barrier beliefs was explored among active and inactive participants using a Mann Whitney U test ($p < .01$).

Results: A 62-item barrier-beliefs survey was developed, leading to ten different scales. Data provided a validation of all scales, which were proven internally consistent. The ranking of the most endorsed barrier beliefs in active and inactive participants were the same, although significantly more inactive participants perceived barrier beliefs to physical activity.

Conclusion: This study developed a social cognitive framework of barriers related to physical activity in active and inactive people. Findings contributed to a theory-based measurement of barrier beliefs about physical activity and provided insight in causes of physical inactivity and relapse.

INTRODUCTION

Regular physical activity (PA) leads to a lower risk for all-cause mortality among adults[1] and leads to prevention of chronic diseases such as diabetes, cardiovascular diseases, several cancers and obesity[2]. Additionally, studies showed that an increase of PA causes a significant decrease of healthcare costs[3]. PA interventions seem appropriate to encourage people to be physically active. However, only sustained PA can have relevant effects on health and the prevention of illness. Because a majority of individuals relapse to a less active or to an inactive state when intervention support is no longer provided, earlier research showed that these interventions appear to have limited impact in the longer term[4-7]. Therefore, understanding inactivity and relapse from PA is needed to develop appropriate intervention strategies for sustained PA.

People who are physically active often come across with some type of difficulties to continue practicing it. It is agreed that the analysis of *barriers* that hinder the adherence to the daily practice is a key factor in initiating PA and the prevention of relapse[5,8-12], while earlier studies provided information about the detection of barriers, or applied instruments that assessed barriers to PA[8,13-25]. In summary, these studies mention barriers such as, lack of time, high financial costs, health complaints, lack of safety, lack of facilities, bad weather, no transport, no family assistance or child care support. But, the conceptualization of barriers is poorly embedded into behavioral models and no theory-based instruments are known to measure BBs. So far, barriers are mostly considered as factual realities that inhibit PA.

From a social cognitive perspective and in the context of this study, defined barriers are *thoughts* or *verbalized experiences* of a person about obstructing factors for PA[48]. Only few studies analyzed *perceived* barriers to PA[39]. From this perspective, barriers are *beliefs* of specific factors that stand in the way of engaging in PA. In our earlier study we describe that beliefs obstructing the pursuance of a PA goal can be conceptualized as *barrier beliefs* (BBs)[57]. BBs refer to people's mental representations of the causes of their lack of initiation or relapse; BBs are attributions about what is obstructing their PA behavior. Two types of BBs can be distinguished: 1) negative self-efficacy expectations, referring to a judgement of a low personal ability to deliver a specific task, and 2) negative outcome expectations, referring to the expected occurrence of aversive or undesired effects of a specific behavior. The assumption is that when barrier beliefs outweigh the urgency and motivation to engage in PA, they obstruct the pursuance of PA by preventing or disturbing the goal related behavior: The more BBs are perceived, the more PA is inhibited. It is supported by a recent review on empirical data, that peoples beliefs about capabilities and consequences of PA behavior are highly predictive of the maintenance of PA[26].

To analyze BBs related to PA, we decided to newly develop a BBs survey based on the Social Cognitive Theory[27] and on a grounded theory. Firstly, we argue that BBs are related to behavior negatively; they inhibit behavior. Secondly, we hypothesize that BBs are associated with the different social cognitive determinants of behavior. Therefore, to validate the developed BB survey, we measured the association between BBs and social cognitive determinants of behavior[26-29]: PA intentions[30,31], behavioral control[32-35], and perceived pros[34,36-39]. The stronger

BBs are endorsed, the lower the intention, the lower the behavioral control, and the lower the motivation (assessed by the perceived pros of PA) is expected to be.

Although BB are conceptualized as a personal "diagnosis" of why a goal is or might not be accomplished, BBs may also be used as "excuses" to legitimize goal abandonment. That is, BBs may be used to eliminate self-discrepancy[40]: people mentally construct reasons why they (no longer) engage in PA. We hypothesize that people who acknowledge that they are inactive, more frequently use BBs as excuses compared to people who feel that they are sufficiently active. Differences between actives and inactives on barriers to PA have been proved empirically[41-45]. However, no data are available with regard to a difference in function of BBs between active and inactive people. In the present study we explore this issue.

Because studying BBs is important in the improvement of PA participation, and no theory-based instruments were known to measure barriers to PA from a social cognitive perspective, the first aim was to develop a BBs questionnaire, based on a social cognitive theory and a grounded theory. Secondly, the internal reliability of the BB survey and cross-sectional relationships between existing BBs and PA behavior and its psycho social determinants were examined. Thirdly, a difference in endorsement of BBs was explored among active and inactive study participants.

METHOD

Survey development

A BBs survey was developed; items were obtained from 1) a qualitative study through recordings of individual counseling sessions and 2) a literature search of barriers related to PA 3) from expert meetings.

Counseling conversations. To explore BBs related to PA the conversations in a counseling intervention with 12 inactive participants were audio taped. The counseling sessions were part of a Randomized Clinical Trail in which the effects of counseling were subject of the study. Participants had to meet the following inclusion criteria: age 18 and 80 years, inactive defined as: less than 30 minutes a day moderate physically active, according to the American College of Sports standards for moderate physical activity[46], and willing to sign up for a counseling intervention. The activity level was measured by the Short Questionnaire to Assess Health-enhancing physical activity (SQUASH questionnaire)[47]. Exclusion criteria were symptoms of chronic depression or chronic pain. A counsellor audiotaped sessions to obtain detailed information about current lifestyle, goals and BBs related to PA. Three counseling appointments of each participant were audio taped and transcribed verbatim measuring goal related BBs. Rationale of the first three counseling appointments was 1) current and past PA behavior and health related beliefs, 2) general health goals and goal related beliefs, 3) specific PA goals and goal related BBs. Results of the counseling conversations were analyzed by two researchers using an open coding indexing technique to identify BBs. Any differences between researchers

were resolved by discussion. Yielded BBs were compared and were defined.

Literature search. To explore additional BBs related to PA from literature an electronic database search was performed in MEDLINE (Pubmed), Embase, PsychINFO, Scopus, and the Web of Science from 1980-2012. For all databases, the following search terms were used in titles and abstracts fields: [(exercise or 'physical activity') AND (barrier* or relapse or obstruct* or maint* or adher*) AND (behavior* or 'social cognitive')]. The topic of the studies had to be PA, combined with barriers. After reading of the abstracts, full-text articles were selected as eligible. A hand search of the reference list was conducted for additional potentially relevant studies. Yielded barriers were listed and compared between researchers. In total 49 different studies were found, nineteen studies were excluded because of not meeting the inclusion criteria, while four studies were omitted based on lack of specific barriers. Two studies were added after searching the citations. In total 28 full-text articles were assessed to determine eligibility. Yielded barriers were compared and listed in the survey.

Expert-meetings. To define existing BBs related to PA, expert-meetings were organized to compare the counseling conversations and outcomes of the literature search. Then, BBs were scaled by type to explore clusters of inhibiting beliefs. A psychologist, a behavioral scientist, a researcher in health psychology, counsellors, nurse practitioners and general practitioners were asked to label yielded 62 BBs to define scales. With these scales a preliminary survey was composed. Finally, the survey was examined for face validity by six trained counsellors familiar with the PA and health behavior literature.

Participants and procedure

A cross-sectional descriptive study was conducted to explore BBs in both active and inactive adults from the general population. Dutch participants between 18 and 80 years old were recruited from April-June 2012 via social media (Facebook, Twitter and LinkedIn, in online communities related to healthy lifestyle), mailings (companies, universities) and advertisements in local newspapers in the Northern parts of the Netherlands. The advertisement invited active and inactive people to join a study on barriers to PA. They were asked to fill out a single digital survey on a website. Participants were informed about the purpose and procedure of the study before they filled out the survey. Finishing and returning the survey electronically were considered as consent to use their data in the study.

Data collection

The survey took about 30 minutes to fill out. The first sections contained questions on personal characteristics: gender, age, residence, work, marital status, number of children and level of education ('low educated' meaning primary and lower vocational education; 'medium educated' meaning secondary and higher vocational education; 'high educated' meaning bachelor degree, master degree and tertiary education (e.g., PhD, post-doc, etc.).

Second, participants filled out the SQUASH questionnaire to assess their leisure time physical activity[47]. The total activity scores on the SQUASH are considered to be sufficiently reliable and

valid to measure the level of physical activity of a healthy adult population. To distinguish between the active and inactive, we argued in the introduction that the identification of one's PA level had to rely on peoples own perception of being sufficiently active or not. A single-item was used: "do you think you are sufficiently physically active"? ('yes'/'no')'.

Thirdly, for assessing validity, different psycho social determinants, as argued in the introduction, were assessed by a self-report on intention to change, perceived pros, behavioral control based on social cognitive theories[28,48-50]. For inactives and actives operationalization was differently indicated in the following. *Intention to change* was assessed with: 1) "I intend to start in the next 6 months to be more physically active" (inactives)/"I intend to continue my current physical activity to sustain the next six months"(actives); 2)"It is likely that I will start in the next 6 months to be more physically active"(inactives)/"It is likely that I keep my current physical activity to sustain in the next six months"(actives); 3) "I am willing to start in the next 6 months to be more physically active"(inactives) ('strongly disagree' (1) – 'disagree' (2) – 'neutral' (3) – 'agree'(4) - 'strongly agree' (5))/"I am willing to continue my current physical activity to sustain in the next six months" (actives) ('strongly disagree' (1) – 'strongly agree' (5)). *Perceived pros* was assessed with one answer that was most applicable: 5) "Being more physically active, has huge benefits for me" (inactives)/"Maintaining physically active has huge benefits for me"(actives) ; 4) ".. has benefits for me"; 3) "..has little benefits for me"; 2) "..has no benefits for me"; 1) "I don't know". *Behavioral control* was assessed with: "If I wanted, I could be more physically active"(inactives)/"If I wanted, I could be maintain physical activity"(actives), "I am able to be more physically active" (actives)/ "I am able to maintain physical activity", "Being more physically active is difficult for me" (inactives)/"Maintain physical activity is difficult for me"(actives), and "Being more physically active is easy for me"(inactives)/" Maintain physically active is easy for me" (actives) ('strongly disagree' (1) – 'disagree' (2) – 'neutral' (3) – 'agree'(4) - 'strongly agree' (5)).

Fourthly, the BBs survey was presented. Participants had to indicate on a 5-point Likert-scale to what extent they agreed that the presented BBs applied on them: "To what extent do you think that the following beliefs obstruct you to start PA?"(inactives)/"To what extent do you think that the following beliefs obstruct you to maintain PA?"(actives) ('strongly disagree' (1) – 'disagree' (2) – 'neutral' (3) – 'agree'(4) - 'strongly agree' (5)). The BBs survey including 62 single BB's, categorized into 10 main scales, is listed in Table 2.

Data analyses

Internal reliability of the BB scales and the whole BBs survey were analysed using a Cronbach's Alpha analysis. Validity of the developed BBs instrument was assessed by a Pearson correlation ($p < .05$) and a multiple linear regression analyses, using the Stepwise method, relating outcomes on BB scales and the psycho social determinants intention to change, perceived pros, behavioral control and self-reported PA behavior (SQUASH-score on leisure time PA). Existing BBs were compared in the active and inactive population using a Mann Whitney U test ($p < .01$). For all analyses SPSS (SPSS Inc, Chicago, IL) version 20 was used.

RESULTS

Participant characteristics

In total 394 participants started to fill out the survey. Five participants were excluded because they were too young, while 123 were omitted from the analyses because they did not completely fill out the BBs survey, leaving 266 participants to be included. Notable characteristics are that 74% of participants were male, 55% classified themselves as active, the mean age was 49 years (SD= 16), 73% had a high level of education, and 51% was married (Table 1).

Table 1: Sociodemographics of participants

	n = 266*	Mean /Median
Activity level		
Active	147 (55 %)	
Inactive	119 (45 %)	
Gender		
Male	195 (73 %)	
Female	71 (27 %)	
Age (years)	266	49/52
Paid work	184	
Education level		
High educated	194 (75 %)	
Middle educated	53 (20 %)	
Low educated	12 (5 %)	
Marital status		
Married	135 (51 %)	
Single	65 (25 %)	
Living together	49 (18 %)	
Relation	16 (6 %)	
Working or housewife	184	
Having children	169	

* in case of less than n =266 in frequencies cases were missing

Identified BBs

Experts were able to categorize defined BBs into different scales grounded on the propositions of social cognitive models on behavior[51,52]. Categorizing of BB's revealed 10 main scales in the BBs survey, five referring to negative self-efficacy expectations in tasks that have to be conducted to engage in PA, such as "physical environmental factors", and five referring to different types expectations of negative consequences of PA, such as "missing positive outcomes of the old behavior" (Table 2).

Table 2: Description of types of barrier-scales in the barrier-beliefs survey

Barrier beliefs scales	Reflecting:
Self-efficacy related	
Physical environmental factors	The inaccessibility of facilities, or counteracting conditions of the surrounding environment in performing PA
Social situations	A perceived deficiency in social support, or presence of social discouragement in performing PA
Prioritizing	The thought or verbalised experience that other behaviors are more important than PA in a specific moment and context
Investment factors	The costs of engaging in a difficult task, or coping with an aversive PA experience
Skill factors	The perceived disabilities to carry out PA-related tasks with pre-determined results of the PA behavior
Negative outcome expectancy related	
Missing the positive outcomes of the old behaviour	A loss of the functions of the old behavior that needs to be given up to become physically active
Negative feelings about the new behavior	Aversive emotions caused by performing PA
Negative outcomes of the new behavior	Negative experiences or results to the person following PA behaviour
Identity discrepancy	A contradiction between representations of the self in a context of performing PA causing an emotional vulnerability
Disappointing results	A non-correspondence between the experienced outcomes of PA with the expected outcomes of PA, yielding a deficient reward of effort

Internal consistency

Internal consistency analysis with Cronbach's Alpha (α) shows on all BB scales an $\alpha > .71$, except on 'physical environmental factors' ($\alpha = .65$) (Table 5). Within the BB scales almost all single BBs scored an item-total correlation $r > .50$.

Validation analyses

Significant correlates emerged from all of the BB scales with identified psycho social determinants, and all associations were in the expected direction. Table 3 shows that the *intention* correlated significantly with all BB scales ($r = -.21$ to $-.37$). In the end-model of the Stepwise multiple linear regression analysis the *intention* was significantly explained by one BB scale: 'prioritizing' ($R^2 = .14$; $p < .01$; $\beta = -.37$). *Perceived pros* correlated significantly with all BB scales ($r = -.17$ to $-.46$), and was explained in the end model ($R^2 = .20$; $p < .01$) by one BB scale: 'disappointing results' ($\beta = -.44$;). *Behavioral control* correlated significantly with all BB scales ($r = -.22$ to $-.78$), and was explained in the and model ($R^2 = .22$; $p < .01$) by two BB scales 'investment factors' ($\beta = -.31$) and 'skill factors'($\beta = -.20$). *PA behavior* significantly correlated with all BB scales ($r = -.12$ to $-.23$), and was in the end model ($R^2 = .05$, $p < .01$) explained by one BB scale: 'prioritizing' ($\beta = -.23$) (Table 3 and 4).

Table 3: Pearson correlation between barrier-belief scales and psycho social determinants

Barrier-belief scales (r)	Intention to change	Perceived pros	Behavioral control	PA behavior
Physical environmental factors	-.21**	-.19**	-.22**	-.13*
Social situations	-.21**	-.17**	-.25**	-.13*
Prioritizing	-.37**	-.21**	-.37**	-.23**
Investment factors	-.21**	-.20**	-.41**	-.18**
Skill factors	-.23**	-.21**	-.40**	-.12*
Missing the positive outcomes of the old behavior	-.27**	-.21**	-.31**	-.16**
Negative feelings about the new behavior	-.30**	-.27**	-.35**	-.19**
Negative outcomes of the new behavior	-.21**	-.35**	-.27**	-.11**
Identity discrepancy	-.31**	-.35*	-.78**	-.21**
Disappointing results	-.27**	-.46**	-.32**	-.18**

* p < .05 (2-tailed) ** p < .01 (2-tailed)

Table 4: Stepwise regression analysis on barrier scales as predictors of psycho social determinants

Psycho social determinants	Beta	R Square
Intention to change		
Prioritizing	-.37**	.14
Perceived pros		
Disappointing results	-.44**	.20
Behavioral control		
Investment factors & Skill factors	-.31** -.20*	.22
PA behavior		
Prioritizing	-.23**	.05

* p < .05 (2-tailed) ** p < .01 (2-tailed)

Expressed BBs related to PA

Table 5 provides the percentages of participants endorsing the BBs separately for active and inactive participants. Inactive participants expressed ('agree' or 'totally agree' together) on average 11 (SD= 6.9) BBs ranging from 0 to 32. Active participants expressed 5 (SD= 7.0) BBs on average, ranging from 0 to 40. Most expressed BB scales for actives as well as inactives were: "negative feelings about the new behavior", "investment factors" and "prioritizing". Within the BB scales, the most expressed single BBs for actives as well as inactives were "I'm too busy", "I dread to go to the sports club", and "I want to do other things in my spare time" (Table 5).

Table 5: Barrier beliefs about PA in active and inactive participants

Barrier-belief	Cronbachs Alpha	Actives (%)					Inactives (%)					Significance of difference *
		Totally disagree	Disagree	Neutral	Agree	Totally agree	Totally disagree	Disagree	Neutral	Agree	Totally agree	
Negative feelings about the new behavior	**.84**											
Because I dread going to a sports club or -center		36	27	13	16	7	14	25	10	41	10	*
Because I find it boring		37	34	8	13	7	11	23	20	37	9	*
Because I do not like it		44	29	7	12	8	20	22	18	32	8	*
Because I am afraid of injuries		45	30	11	13	1	35	41	4	17	3	
Because I feel like people are looking at me		54	34	7	4	1	42	40	7	9	3	
Because I have little confidence when exercising		56	35	4	4	1	43	40	6	10	1	
Because I 'm ashamed		59	34	6	2	0	47	41	6	6	1	
Because I find it scary		57	36	5	3	0	42	47	7	4	0	
Because I feel than inferior		59	34	5	2	0	49	45	4	3	0	
Investment factors	**.74**											
Because I 'm too busy		21	27	18	26	7	4	25	15	37	19	*
Because I don't have the energy		39	33	10	13	6	14	30	18	33	6	*
Because it's too much trouble to change my lifestyle		39	39	12	7	3	18	31	18	32	1	*
Because I can't easily leave home		57	31	3	6	3	35	44	4	12	4	*
Because I do not have good health		49	35	7	6	3	38	42	10	9	2	
Because I have too many psychological problems		61	35	2	2	1	60	36	1	1	1	
Because it costs me too much money		49	30	11	7	3	28	37	17	18	1	*
Identity discrepancy	**.74**											
Because I'm not sporty		46	29	8	10	7	19	26	18	28	9	*
Because it is not for me		56	28	7	6	3	30	41	16	8	5	*
Because people will look different at me		55	39	4	1	1	42	46	6	6	1	
Because I'm not sure how to behave		57	37	3	3	0	48	42	6	4	1	
Because I do not need it		47	36	12	4	2	34	54	11	1	1	
Dissapointing results	**.89**											
Because it takes too long until I see results		38	42	8	10	3	20	41	11	25	3	*
Because I got little benefit from it in the past		53	38	3	3	4	28	51	12	7	2	*
Because my symptoms do not diminish		49	34	8	5	3	34	40	16	10	1	
Because I do not feel healthier		52	34	7	4	3	40	42	9	9	0	
Because I do not see any results		48	39	8	3	2	33	46	16	6	0	*
Because I don't get anything from it		58	30	7	3	3	40	45	13	3	0	*
Because I don't see the benefits of it		62	29	5	4	1	48	47	2	3	0	
Skill factors	**.71**											
Because I have no perseverance		45	33	13	7	2	14	29	19	32	6	*
Because I can't maintain (the exercises)		38	37	12	13	0	11	31	24	31	4	*
Because I find it hard		45	39	12	3	0	21	40	20	16	3	*
Because I am not able to due to an injury/handicap		48	27	8	12	4	38	39	9	9	4	
Because I'm clumsy		53	39	4	3	2	40	43	7	10	0	
Because I'm afraid that my body cannot stand it		57	33	6	5	0	55	34	6	5	1	

Physical environmental factors	**.65**											
Because the weather is bad		34	39	8	18	1	23	28	20	28	1	*
Because it gets dark too early		48	39	4	8	1	36	39	13	11	1	
Because there are no sports facilities nearby		56	36	5	3	1	35	48	9	7	1	*
Because it is not possible in or around my house		45	44	5	4	2	41	42	8	10	0	
Prioritizing	**.76**											
Because I want to do other things in my spare time		32	32	14	16	7	11	23	19	40	7	*
Because of my daily activities I don't have the opportunity		39	36	9	13	3	11	36	16	31	6	*
Because I'm not used to it		53	36	7	3	1	25	30	16	26	3	*
Because I'd rather go by car instead of walking or biking		57	34	7	3	0	32	37	11	18	2	*
Because I've never considered it		57	34	7	1	2	54	40	5	1	0	
Because I have other daily activities to do												
Social situations	**.78**											
Because I have no one to go with		45	34	12	7	1	25	38	16	16	5	*
Because I'm afraid to be the worst in the group		53	34	7	6	1	37	42	10	9	2	*
Because there is no one around me who is interested		52	40	4	3	1	34	46	11	9	0	*
Because I do not dare to go alone		56	35	7	3	0	46	42	5	8	0	
Because people around me stop me		63	33	2	3	0	52	40	5	4	0	
Because the general practitioner (GP) discourages me		58	31	6	4	1	65	35	1	0	0	
Because other people discourage me		61	35	3	1	1	62	36	1	0	0	
Because I don't want to go alone		45	39	5	11	0	30	33	11	25	1	*
Missing the positive outcomes of the old behavior	**.82**											
Because than I won't be able to maintain my social contacts		46	38	7	7	3	22	54	13	11	0	*
Because than I won't have time to see my partner/ family		53	32	3	9	3	31	46	9	13	1	*
Because than I can't do my daily activities		39	38	8	12	3	19	44	11	25	1	*
Because than I have too little time for things that I like		35	37	11	12	6	13	38	18	24	8	*
Because I cannot relax than		57	31	6	6	1	41	37	7	13	2	*
Negative outcomes of the new behavior	**.79**											
Because I get pain in my body		48	38	7	5	3	36	42	11	10	2	
Because it's tiring me		49	38	7	6	0	34	47	9	10	1	*
Because I do not want to sweat		58	36	3	3	1	42	43	7	8	1	*
Because I get muscle pain		54	36	5	3	2	44	44	6	6	0	
Because I do not want to be muscular		53	34	8	3	2	44	45	8	4	0	
Because it is harmful to my body		53	33	8	6	1	46	44	7	3	0	
The barrier-beliefs survey (all barrier-belief scales together)	**.93**											

* Difference is significant at the .01 level (2-tailed)

Differences between actives and inactives in expressing BBs

Table 5 shows that 34 of 62 BBs were significantly ($p < .01$) more expressed by inactives than actives, such as: "I'm not sporty" (inactives 37%; actives 17%), "Because it takes too long until I see results" (inactives 28%; actives 13%), "Because I have no perseverance" (inactives 38%; actives 9%), "Because the weather is bad" (inactives 29%; actives 19%). One BB was significantly expressed more by active participants: "Because I don't get anything from it" (actives 6%; inactives 3%). Additional Pearson correlation analyses between the number of BBs expressed and self-reported leisure time PA, proved a significant association ($p<.01$; r= -.20).

DISCUSSION

From a social cognitive perspective and in the context of this study, defined barriers were thoughts or verbalized experiences of a person about obstructing factors for PA. BBs were recognized that are related to: 1) negative self-efficacy expectations; 2) negative outcome expectations. The qualitative findings in the grounded theory provided the content of these two broad factors, leading to five scales each. All BB scales as well as the whole BB survey turned out to be internally consistent.

To validate the developed BB survey, the association between BBs and social cognitive determinants of behavior - PA intentions, behavioral control, and perceived pros - was assessed. All correlations were significant, in the expected direction, ranging from -.17 to -.78. More importantly, the scales also were significantly and negatively related to PA behavior, as assessed with the SQUASH. These data provide a validation of all ten scales: Endorsing BBs is related to lower levels of PA.

The scales all correlated significantly and positively with each other, and the multivariate analyses suggested mediation: Only a limited number of BB scales were related to the social cognitive determinants. Especially the subscale "prioritizing" seemed to be central: Regarding PA intentions and PA behavior, it was the only scale left, suggesting that it mediated the relation of all other scales. This might mean that it all comes down to setting priorities to allocate the available resources to engage in PA. All of the described barriers in the BB questionnaire can be overcome objectively with high prioritizing, that is, with a strong motivation. Thus, barriers must be seen in relation to one's motivation to invest in PA. Although this might suggest that in stimulating PA the motivation should be central, research shows that it is not easy to maintain a strong motivation in the longer term[53-56]. As long as motivating stimuli are salient - such as regularly contact with a coach, ongoing physical complaints that may be controlled by PA (e.g., high blood pressure, minor pains), and an enthusiastic social environment - people may invest in overcoming barriers. However, when these stimuli disappear or investments are needed in other important life areas (e.g., work), people may lower their investments in PA. Therefore, the perceived barriers should be lowered so that the default long-term motivation of people is enough to overcome the barriers. To this end, an intervention with four change strategies has

been developed aimed at lifestyle changing[57]. It comprised actions of the counsellor with the goal to: 1. develop means to reach the goal; 2. change goals to change BBs; 3. restructure/change BBs, and 4. accept the investments and costs demanded by BBs.

The most expressed types of BBs in both actives and inactives were "*investment factors*", "*negative feelings about the new behavior*" and "*prioritizing*" consisting of single BBs, such as "I'm too busy", "I dread to go to the sports club" and "I want to do other things in my spare time". These findings confirm earlier studies[58,59]. In particular, "Lack of time", similar to our "I'm too busy", has been the most highlighted barrier among the inhabitants of the European Union[60]: 45% of the Europeans state not having enough time to practice exercise, with Holland head up the list. This similarity in identified PA-barriers between the current study and earlier research favors validity of the developed BBs instrument.

Results of this study showed that inactives expressed more BBs compared to actives: On 34 of the 62 BBs inactives more strongly agreed that the specific BB caused them to experience difficulties "in starting PA" (compared to "in maintaining PA" in actives). Additionally, the found association between the number of BBs present and self-reported leisure time PA, accords to a suggestion that the higher the number of perceived barriers the higher the occurrence of physical inactivity[45]. Firstly, those who are active may have already overcome several barriers, and therefore do no longer perceive these barriers. For example, while at the start they may have thought PA is boring and would have perceived this as a barrier, after a while they learn that this is no longer an issue. Secondly, it may be that the difference is related to the hypothesized different functions of BBs: In addition to identifying BBs to start engage in PA, they also may be motivated to legitimize their inactivity, thereby needing to endorse more BBs.

However, with the present data we were not able to validate the expected different functions of BBs between actives and inactives, although we assume that the distinction between actives and inactives is made correct. The self-report measure was only weakly related the SQUASH-scores on leisure time PA ($r = .28$; $p<.01$), indicating it is not so much a measure of PA-level. This suggested that the measure indeed largely assessed satisfaction with the own level of PA, as intended. In a coaching setting, BBs of actives vs. inactives may be worded the same despite a possible difference in function. Differences may only be revealed in the ongoing process of coaching and practicing PA. In conclusion, future research should include a more explicit design to identify the different functions of BBs.

Strengths and limitations

This study had strengths and some limitations. Strength of this study was the development of a new theoretical framework of BBs, based on social cognitive theories, in combination with its operationalization and an empirical test. One next step would be to further verify statistically the model on empirical data.

There are some limitations. Firstly, probably not all BBs were covered by our survey; especially cultural specific or more personal barriers were not included. BBs should be further explored in populations with different cultures (e.g., overweighed, age-groups etc.). Secondly, although the

number of participants was quit high, generalizability of the results of BB measurements may be lowered because the sample was high educated, men were overrepresented, and the mean age was quite high. There is evidence that BBs may vary depending on age and gender[61,62]. Also, nothing is known about the barrier-status of non-respondents. The number of participants who did not complete the survey was high (31%). Thus, a self-selection bias might have altered the results.

Conclusions

This study contributes to exploring barriers about PA from a social cognitive perspective. The findings give preliminary insight in physical inactivity and relapse and may inspire healthcare practice as well as research on PA-stimulation. The next step would be to further investigate important BBs related to PA in different populations and to verify statistically the theoretical structure of the BB instrument on empirical data. Also a potential difference in function of the usage of BBs in inactive and active people and the effects of change strategies to cope with BBs should be analysed in sequel. In the end, the availability of effective evidence-based interventions for PA-stimulation has the potential to an increase health and prevent illness.

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CHAPTER 4

THE BARRIER-BELIEF APPROACH IN THE COUNSELING OF PHYSICAL ACTIVITY

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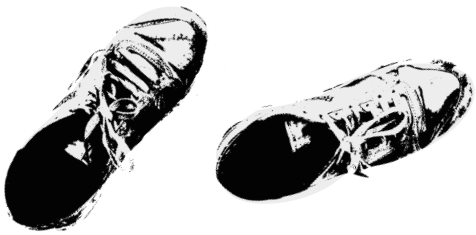

ABSTRACT

Aim: To describe a cognitive theory on motivation and relapse in order to stimulate physical activity and prevent relapse, and to explain how different types of barrier beliefs play their role in increasing sustainable lifestyle changes.

Method: We conducted a literature search to explore barriers to PA. Social cognitive theories and empirical evidence were evaluated and guided the process developing a theoretical framework and counseling strategies.

Results: A theoretical framework is presented to understand why people do not engage in PA and often relapse once they started PA. A distinction is made between three related types of BBs. In PA counseling these three beliefs are addressed using four different BB behavior change strategies.

Conclusion: BB counseling aims to develop an individual pattern of PA for the long term that is adapted to the (often limited) motivation of the client, thereby preventing the occurrence of BBs. The client will learn to cope with factors that may inhibit PA in the future.

Practice Implications: The BBs approach composes a way of counseling around the central construct of barrier beliefs to stimulate engagement in PA independently, in the long term.

INTRODUCTION

Physical inactivity is a worldwide growing problem with one out of five adults being physically inactive[1]. Physical inactivity is a risk factor for chronic diseases such as diabetes and cardiovascular diseases, overweight and several cancers[2]. Regular physical activity (PA) is positively associated with fitness and health related benefits and related to an estimated 30% reduction in risk for all-cause mortality among adults[3]. Engaging in regular, moderate-intensity PA is important for the promotion of physical and mental well-being[4], and the prevention and management of many chronic diseases[5,6,7]. In addition, stopping or markedly reducing PA can result in a significant reversal of initial health improvements[8,9]. Thus, to improve physical and mental health and to prevent illness, it is important that people engage in PA on a regular basis. However, despite the well-known benefits of PA and the availability of effective PA interventions, many people do not engage in sufficient PA. For example, around the world percentages of physical inactivity vary from 20% up to 70% in different countries, with about 40% in the United States of America, and over 60% in the United Kingdom[10].

In addition, when people start engaging in PA, they often relapse to inactivity, even when they take part in PA interventions[11]: Results of systematic reviews and meta-analyses of long-term effects indicate that a majority of individuals relapse to a less active or to an inactive status when intervention support is no longer provided[12-15]. However, only sustained PA can have relevant effects on health and the prevention of illness. For a sustainable behavioral change, Greaves' review[20] suggests that future interventions should add behavior maintenance strategies. These strategies should target the most influential determinants of PA mainte-nance[17-21].

In conclusion, PA interventions can lead to higher levels of PA, which is related to several beneficial physical outcomes. However, many people do not engage in sufficient levels of PA and do not use these interventions, and when they do use PA interventions, they often relapse. Therefore, there is a need for understanding inactivity and relapse from PA, and for theory-based behavior change strategies to stimulate and support maintenance of PA.

THE THEORETICAL BACKGROUND

Barriers inhibit PA

In research on PA, the general term barrier is often used to refer to very different factors that hold people from initiating PA or that cause relapse from PA. In summary, these studies mention barriers such as, lack of time, high financial costs, health complaints, lack of safety, lack of facilities, bad weather, no transport, no family assistance or child care support[22-30]. In these studies barriers are often seen as more or less fixed factors that inhibit PA, and it is generally agreed that focusing on barriers is important to counter relapse[31-42].

From a psychological perspective, an important question is: 'How do these barriers influence PA?'. Our answer is that the mental representations of these barriers are central.

These representations become manifest in people's beliefs about their reality. In psychological theories, the most important beliefs related to barriers are attributions, self-efficacy, and negative outcome expectancies[43,44]. In the present theorizing, these three types of beliefs are called *barrier beliefs*.

In this article we will, firstly, present a cognitive theory on motivation and relapse, and explain how the three types of barriers beliefs play their role. The core assumption is, in line with general cognitive-behavior therapy, that barrier beliefs are actual causes of inactivity or relapse. Secondly, in this article we will present a set of cognitive and behavioral strategies that are developed to deal with these barrier beliefs in order to motivate PA and prevent relapse. These counseling strategies can be applied in the process of (re)starting to engage in physical exercise, as well as in supporting maintenance of physical exercise.

Barrier beliefs and goals

Barrier beliefs (BBs) regarding PA are thoughts or verbalized experiences or estimates of a person about what is keeping him or her from starting or maintaining PA. BBs are a cluster of beliefs that all refer to people's perception of the more or less specific or concrete factors that stand in the way of engaging in or maintaining PA. Importantly, the starting point is that people have at least some knowledge on the benefits of PA: BBs can develop when people feel they should set a PA goal, when they are setting a PA goal, when they have set a PA goal, or when they are working on a PA goal. BBs are related to goals in the opposite direction; they obstruct the achievement of goals by preventing or disturbing the goal related behavior. Although BBs regarding PA may have different sources - from hearing from others, through mass media, or based on the own experience - they have in common that they inhibit PA.

Attributions, self-efficacy and negative outcome expectations

BBs manifest in one of three types; as attributions of PA-inhibiting causes, as self-efficacy expectations in engaging in PA, and as negative outcome expectations of PA.

Attributions. Attributions are beliefs about the causes of behaviors, including one's own PA behavior[45,46]. People spontaneously develop attributions for different reasons but one reasons is problem solving[47]: When people notice that their goal accomplishments are inhibited, they start seeking for the cause of the inhibition. In the framework of PA, people's attributions are their diagnosis about what is holding them from engaging in PA. The concept of perceived barriers actually refers to people's attributions to not engage in PA or relapse from PA[48]. Attributions may be based on undeniable facts (e.g., 'I cannot walk because my leg is broken'), on interpretations of experiences or observation (e.g., 'I stopped jogging because I may overburden my foot'), or on seemingly farfetched inferences (e.g., 'I do not exercise anymore because it spoils the fixed and limited number of heart beats I have in my life'). However, once they have developed they may govern behavior; they are 'true' for the person as representations of reality and, thus, as a basis of the behavior. Therefore, attributions as BBs regarding PA are important manifestations of the

psychological causes of what inhibits people to engage in PA. In counseling people, attributions of inhibiting causes are a starting point for the diagnosis and treatment of inhibited PA.

Self-efficacy expectations. Self-efficacy expectations can also be regarded as BBs. Self-efficacy is concerned with people's beliefs in their ability to perform a specific action that is required to attain an expected and desired outcome of the behavior[49]. In the framework of barriers, self-efficacy expectations refer to 'being able to accomplish the task of overcoming a specific barrier', for example, 'being able to engage in 30 minute outdoor exercise despite the bad weather'. High self-efficacy expectations will neutralize the inhibiting effects of the barriers (the bad weather). High self-efficacy expectations motivate people to invest in their behavior because it will pay off: They perceive the desired outcomes as within their reach. Perceived behavioral control is a similar construct[50] but in its theory more explicitly based on underlying beliefs on one's control over a task. Empirical data show that self-efficacy is related to barriers to PA[32-38,50], and to PA maintenance[51,52].

Self-efficacy expectations in overcoming a specific barrier can be based on various sources[44]: Comparing to other people's accomplishments (e.g., 'when he cannot do it, I certainly cannot'), interpretation of physical sensations (e.g., 'my increased heart rate during PA is a sign of illness, I have to be careful'), social influence (e.g., 'maybe he is right and I *cannot* do this'), and enactive learning (e.g., 'I cannot do this because I failed before'). Thus, different types of knowledge can support self-efficacy expectations, for example - as related to the above sources - knowledge about how others do, and how the body works. In conclusion, in counseling people, low self-efficacy expectations as BBs are another starting point for the diagnosis and treatment of inhibited PA.

Negative outcome expectations. Negative outcome expectations can also be conceptualized as BBs. Negative outcome expectations consist of beliefs about the occurrence of aversive or otherwise undesired effects of a specific behavior[44]. They are the cognitive derivate of punishment in operant conditioning. The PA-inhibiting expected 'punishments' may be diverse: They may be social (e.g., expected negative social reactions), physical (e.g., expected aversive physical sensations or damage) or monetary (i.e., expected financial costs).

Negative outcome expectations are often based on negative experiences related to being physically active (e.g., 'I feel more tired instead of feeling better' or 'my knee hurts as a consequence of this walking intervention'). These negative experiences translate into expectation on what will follow when one keeps on engaging in PA, or on what will happen next time someone will engage in PA. Expectations of negative outcomes have been shown to be related to relapse and maintenance in PA[43]. The type of negative outcomes people are sensitive to varies among people and maybe based on knowledge or individual history. For example, some people may especially dislike aversive physical sensations because they are inclined to catastrophize, while others are especially sensitive to negative social reactions on the basis of past experiences. In conclusion, in counseling people, negative outcome expectations as BBs are another starting point for the diagnosis and treatment of inhibited PA.

Relating different barrier beliefs

The three well-defined BBs, attributions of inhibiting causes, low self-efficacy expectations, and negative outcome expectations, can be understood as different mental representations concerning barriers that are closely related (see Figure 1). For example, one barrier a person forwards to explain his or her relapse from PA may be a lack of time. First of all, this explanation implies an attribution of inhibition: A perception of the cause of a certain event or behavior, in this case, stopping PA. Secondly, handling time constraints may be conceptualized as a task, for which a certain level of self-efficacy is needed to be accomplished. For example, time management skills may be used to handle time constraints. Thirdly, time as a barrier may imply that engaging in PA despite the time constraints is expected to have negative outcomes: It may be that a person expects that engaging in PA will be at the cost off other personal goals. Thus, attributions are end-conclusions; they explain explicitly what causes a person to not engage in PA or what caused relapse. They always refer to a task that cannot (easily) be overcome (self-efficacy expectations) or to a negative experience or outcome (negative outcome expectations). The three types of BBs are related, but each provide their own information on the psychological representations of the factors that inhibit a person engage in PA.

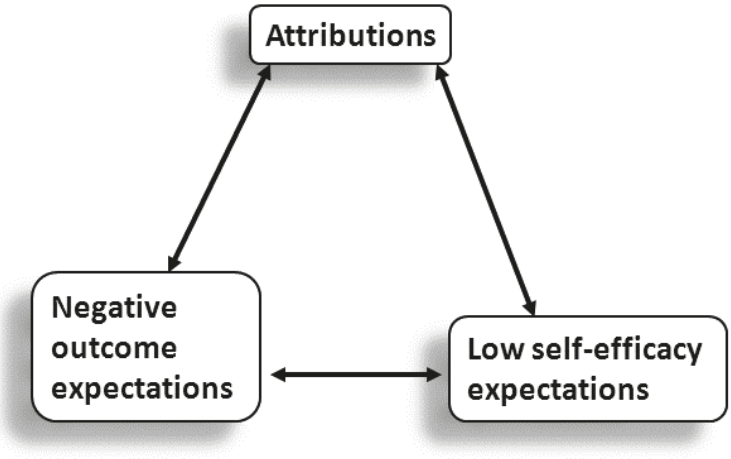

Figure 1: Three types of BBs

Functions of barrier beliefs

Individuals develop BBs for a reason: BBs concern a diagnosis of *why* a goal is or might not be accomplished. In the evolutionary framework of survival and goal setting this is an essential function: People have limited resources and, therefore, it is important to decide to abandon a goal in time to not waist resources. Thus, BBs have a function in resource allocation.

When a person has decided to invest in the behavior of PA to reach desired outcomes, this behavior will be only maintained as long as the person estimates that it pays off. Paying off

refers to the balance between the costs and the benefits. The costs, here, refer to the investment costs of engaging in a difficult task (self-efficacy-related) or coping with an aversive experience (negative outcome expectations-related). When this balance is negative - the costs outweigh the benefits - people may give up. In the control theory, abandoning a goal or giving up is called goal-disengagement and is an essential aspect of effective self-regulation[53].

Besides BBs functions in resource allocation, they can also be used by individuals to legitimize goal abandonment. When a person abandons a goal despite knowledge of the negative consequences of this (e.g., increased risk for CHD because of low PA), a psychological state is activated that is conceptualized as a self-discrepancy[54], cognitive dissonance[55] or a self-threat[56]. This is an aversive psychological state that needs to be dealt with. One way to lower it is by psychologically constructing self-serving 'valid reasons' to abandon the goal: BBs argue that the investment balance is negative and, therefore, it is sensible and legitimized to abandon the goal, for example, 'I cannot do this' or 'I don't like this'. With regard to attributions, this function is called the self-serving bias[57].

Changeability of barrier beliefs

In the above perspective on inhibited PA, changing BBs in PA should be central. However, not all BBs can be easily changed. Firstly, BBs may be related specifically to how people try to reach their goal. For example, engaging in PA on Friday evening may bring negative outcomes that may inhibit a person to engage in PA. It may be that engaging in PA on Friday morning or on Saturday leads to less negative outcomes. Thus, creative solutions may help to change BBs. Secondly, BBs may refer to barriers that cannot be changed. For example, when there is a tornado, self-efficacy expectation in the task of 'jogging despite the tornado' may be low but it is not reasonable to expect that people change their self-efficacy with regard to this task. In this case, it might be better to change the goal (to make the BB irrelevant). Thirdly, BBs may be highly changeable and depend on knowledge. For example, a person may stop engaging in PA because of the negative outcome expectations-related belief that certain physical sensations are early signs of tissue damage. However, this BB may not be valid and it may be changed by knowledge on how, for example, joints work. Fourthly, we must realize that sometimes goals cannot be changed and BBs cannot be changed. In that case barriers might be accepted.

These four aspects related to the (lack of) changeability of BBs are the core of the counseling method using four different BB change strategies presented below.

The barrier-beliefs counseling

In barrier-beliefs counseling PA is stimulated by addressing the BBs. The novelty of this counseling lies in the various ways it addresses BBs to lower their PA inhibiting effect. These ways ca be conceptualized as behavior change strategies[57]. The behavior change strategies comprise clusters and sequences of actions of the counsellor (questions, decisions, etc.) with the goal to: 1) design means to reach the goal; 2) change goals to change BBs; 3) restructure/change BBs, and 4) accept the investments and costs demanded by BBs. These four behavior change strategies must be embedded in a broader counseling process.

General principles of the counseling

The goal of physical activity counseling is to guide clients to engage in PA on the long term; independently of professional support. To engage in PA on the long term, intrinsic motivation is essential[59]. According to Magnan et al. (2013) intrinsic motivation is partly determined by people's affective responses during PA[60]: They found that active people often experience a greater degree of positive affective responses than inactive people do, and a decrease in negative affective responses towards PA[60]. In addition, affective responses seem to be related to the frequency and intensity of PA[61]: Higher frequency and intensity is related to experiencing a 'flow' of feeling good and enjoyment. Thus, to stimulate intrinsic motivation it is important to work towards positive hedonic responses during PA. We argue that the only way to develop this motivation is by enactive learning: The own experience that PA leads to personally relevant outcomes may lead to a robust long-term motivation. In addition, to engage in PA on the long term and to build intrinsic motivation, PA inhibiting factors should be small, thus, BBs should be absent or weak. To be able to independently engage in PA on the long term, clients should be skilled in self-management concerning PA[62]; they should be able to apply the BBs behavior change strategies to their own situation.

A patient-centred approach is applied, meaning that we do not follow general recommendations on the level of PA but focus on individually desired levels of PA. The starting point of the counseling is that benefits for physical and mental health can already be achieved if clients engage in PA less than international recommended 30 minutes per day[63,64,65,66,67,68,69]. Besides sporting, many types and levels of PA can help to satisfy personal goals, for example in transportation and daily domestic activities (lunch walks, cycling to work, gardening, taking stairs), or household or gardening activities, alone or with others. Below we will describe the different subsequent steps and counsellor actions in the counseling process. In this phase, the counsellor develops a preliminary insight into potential barriers through identification of BBs. We will not go into these aspects of counseling and only mention them in sum:

- Personal introduction
- Explanation of aims of the counseling and agreements of the sessions
- PA diagnosis, extensive inventory of:
  - health and behavior measurements
  - current lifestyle related to PA
  - long term goals
  - motivation to engage in PA
  - attitudes, level of self-efficacy and expectations towards PA

Designing action

After the diagnostic information is gathered, a plan for client action can be designed. Most BBs are related to specific goals. Therefore, the client's PA goals must be explored.

Installing minimal motivation. To formulate PA goals, clients must have at least some motivation to engage in PA. That is, people set goals on the basis of their motivation to achieve

certain valued outcomes, such as, looking good, losing weight, or lowering the risk for a heart disease. Importantly, in the present counseling approach, as argued above, the client's motivation to engage in PA is not boosted to set high goals. Instead, the client's spontaneous intrinsic motivation is explored and only when clients miss knowledge on the basic positive effects of PA (e.g., lowering risk for chronic illnesses) they are provided with potentially motivating information. As mentioned above, we believe that the true motivation that will be sufficiently powerful on the long term, is the motivation based on the own experience with PA.

Formulating specific goals and goal related beliefs. The client's overall goals must be investigated, using questions such as: 'What would you like to achieve through this counseling, What do you dream of, What would you change if you could make a wish? What would you like to achieve in 1 month?'. The answers to these questions will help the client to formulate one or more specific PA goals that can be unambiguously evaluated, for instance 'walk 30 minutes every day', 'run the marathon within 6 months', 'go to work on my bike at least 3 times a week', 'to continue my running for the 10 years to come', 'to keep walking in the evening for 4 times a week for at least 10 minutes'. In a hierarchical perspective on goal structures[70], these personal PA goals are based on values, and they set the direction of the more concrete PA intentions, such as 'Tomorrow I will go to my work by bike'.

Investigation of barrier beliefs. The goal-scale ratings are used to support the diagnosis of BBs. By talking about the ratings, the counsellor has the opportunity to observe the spontaneously generated BBs by the client in reaction to PA goals in general or specified goals: attributions of inhibition, low self-efficacy expectations, and negative outcome expectations. In addition, BBs may be explored explicitly, for example by asking 'What keeps you from achieving your goal?' or 'What made you stop?' To support the exploration of BBs and identify the core BBs, BBs also can be rated on their strength (see Figure 2). The information on goals and BBs set the stage for applying the BB behavior change strategies.

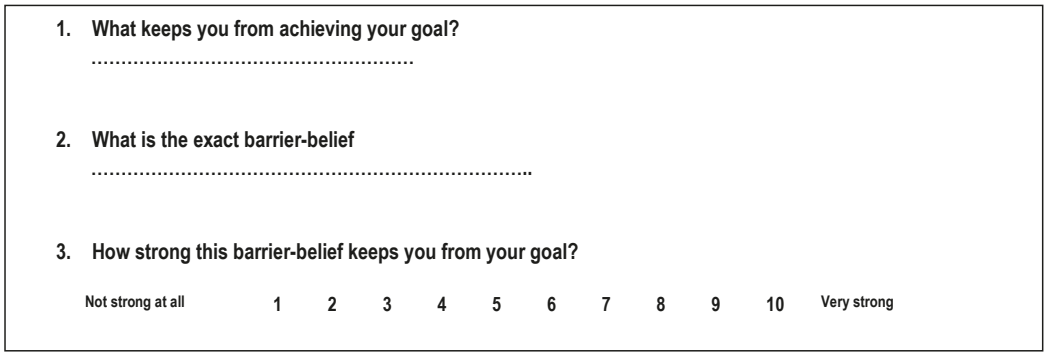

Figure 2: Rating scales of BBs

The BB behavior change strategies

With the above information on the client's psychological representations of barriers, the four main behavior change strategies can be applied. When doing so it is important to be aware of the functions of the BBs: Are they developed in the function of deciding about effort investment or are they in function of protecting the self and legitimizing not engaging in PA? Only when BBs have the investment function the below behavior change strategies should be applied. When BBs have the 'legitimizing' function, they should first be used to identify the motivational conflict that brings up this need. However, mostly it is not immediately clear to what extent BBs are a kind of excuses to not engage in PA. Applying the below BB behavior change strategies may reveal more about the individual's use of BBs (Figure 3).

1. Changing means

This first behavior change strategy that can be applied and is based on BBs - and that is already used in health counseling - is designing ways to reach the goal [71-74]. For example, a BB regarding the goal to 'lose 2 kilograms of bodily weight in four weeks by exercising 5 times a week for 10 minutes' may be 'this costs too much time'. An action plan to reach the goal could be: 'I change my evening routine so that I have more time to exercise'. In this behavior change strategy the goal is not changed but different handling strategies, measures or means are applied to make the goal-directed behavior more feasible. Thus, clients have to find solutions and take actions - set priorities, reschedule, ask other people, use other clothing, etc. - to stick to their goal.

One potential drawback of this BB behavior change strategy is that it still may cost (extra) investments. As long as the motivation is strong, this way may suffice but when motivation declines, the investments may become too high. However, it is also possible to change the means to reach a goal in such a way that less effort is needed. For example, regarding the above situation, it may be more efficient to reschedule PA towards the evening than at daytime.

2. Change goals to change BBs

To lower the investments radically, the PA goal may be changed. The above goal may be changed into 'exercising 3 times a week for 10 minutes' or 'exercising 5 times a week for 5 minutes', or a completely different PA goal may be set, such as 'take a brisk 10 minute lunch-walk every day' or 'take the stairs instead of the elevator'. A variety of creative alternatives can be discussed, and with each feasible alternative BBs must be checked. This goal-setting approach leads to a PA goal with no or with only small barriers. Although the low set goal may have relatively weak effects on health, our premise is that it is better to start small and grow when intrinsic motivation develops, than to start high with increased risk for disappointment and relapse.

3. Restructuring/changing BBs

When BBs cannot be changed by handling them differently and by goal setting, they must be change cognitively. That is, BBs may be based on erroneous knowledge based on different sources. For example, BBs may be 'I feel that people ridicule me when they see me jogging' or

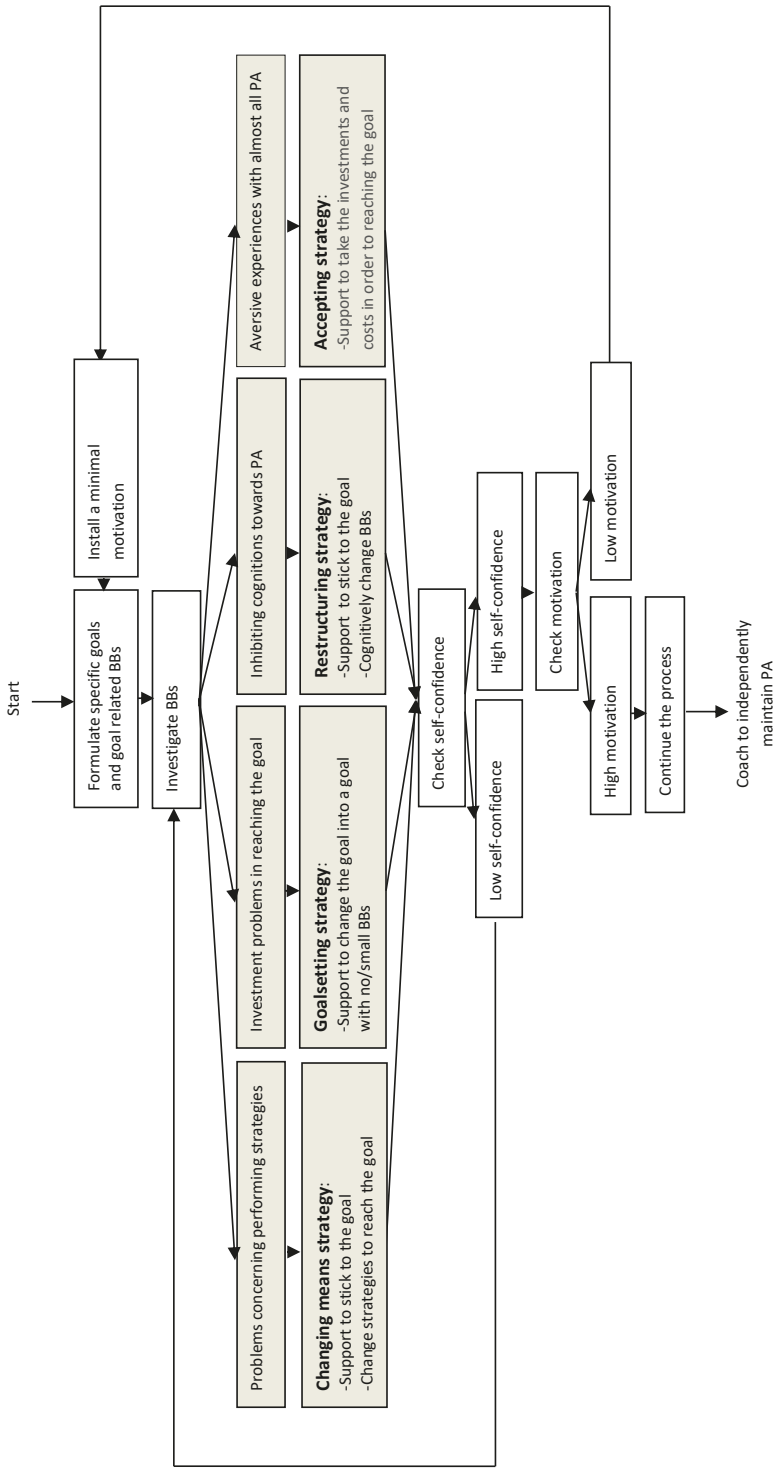

Figure 3. Flowchart of the BB counseling.

'I think it is no use to try to engage in PA regularly again, I already failed so many times'. The first BB primarily refers to an aversive outcome, while the second BB primarily is related to low self-efficacy. Both BBs are interpretations of what people have observed or have experienced. The core question here is 'Is it true?'. As in cognitive therapy in general these beliefs may be challenged in a Socratic dialogue[75]; e.g. 'can you tell me how you came to this conclusion?'), or with experiments ('let us see what happens when you do this'). Often erroneous beliefs related to cardio-vascular or motoric functioning may work as BBs. For example, a patient with osteoarthritis may avoid PA because of the illness belief: 'When I experience pain in my right knee during PA, this signals a damaging process'. Education may provide the clients with the factual knowledge on the evidence of positive effects of PA in osteoarthritis, thereby changing the BB. Thus, clients are supported to stick to their goal but change their perspective on the inhibiting factors they were bothered by.

4. Accepting the investments demanded by BBs

Sometimes handling cannot further be improved, goals cannot be further adapted, and BBs cannot be restructured. For example, when a client experiences pain as a barrier with (almost) every physical movement, or a client finds even small experiences of physical efforts aversive, the inhibiting factors may be accepted. Acceptance means that the investments and costs that come with reaching a goal are not avoided but taken[76]. Just as renting a car has its costs and we do not expect it to be free, reaching a PA goal may be not expected to be for free either. Good acceptance does not remove the factor that might inhibit PA but it lowers or completely removes the inhibiting power of the factor[77,78].

Several strategies can be used to enhance acceptance. For example, by discussing the positive and negative sides of PA, relevant factors may gain or lose value. Consider the BB: 'I feel uncomfortable riding my bike in my neighbourhood, it looks silly'. This BB reveals a negative outcome. However, this negative outcome may be contrasted with the alternatives of not riding the bike or riding the bike elsewhere. The outcomes related to these options may change the relative value of the BB, which is a mechanism of acceptance. The BB: 'The exercise always costs me a lot of efforts' might be acknowledged but placed in the framework of 'nothing is for free, except the sun'. In this way the efforts needed to exercise do not become lower but they feel less unjust. Mindfulness exercises may help clients to not take BBs to seriously[78]. For example, when during PA a person is dwelling on the thought 'This is crazy, that I need so much time to engage in PA', the person might learn to just observe the belief with some distance and 'let it go'. In that way the person may be less bothered by the BB.

Table 1: Various barrier beliefs (BBs) linked to examples of the corresponding counseling strategies.

Barrier Belief	Examples of counseling strategies
"I have no time to run five times a week"	**Changing means:** 'Stick to your goal but try to be more flexible in when you run'
"I feel pain when running 5 times a week"	**Changing goals to change BBs:** 'Change your goal from running 5 times to 3 times, or engage in a different activity'
"I feel pain when I am running and I think this is harmful for my body"	**Restructuring BBs:** 'Let us find out whether your expectation about harm can be true'
"I have no time (anymore) to engage in whatever physical activities"	**Accepting the investment demanded by BBs:** 'You have to accept that you may have to give up something else to take time for physical activity'

DISCUSSION

The presented barrier-belief approach to counseling PA is based on contemporary theoretical models of behavior and on empirical evidence. The theoretical background is social-cognitive and the applied behavior change strategies that target BBs are already used in different change perspectives and therapies. However, in the barrier-belief approach these proven behavior change strategies - change means reach goals, set (different) goals, restructure beliefs, induce acceptance - are all applied to target the core of problems with initiating and maintaining PA. Using well-known theories and strategies, the barrier-beliefs approach composes a way of counseling around the central construct of barrier beliefs.

The strong focus of our approach on BBs does not mean that the approach is narrow. The BBs comprise the most important psychological factors that have been shown to be related to starting and maintaining PA: perceived barriers (attributions), self-efficacy expectations and negative outcome expectations[43,44]. In addition, in the counseling method the four behavior change strategies are applied in the context of general counseling methods, such as, developing rapport, making agreements, and providing assignments. In addition, within the four strategies common elements in counseling, such as providing knowledge on facts and on skills, are applied. Thus, the present BB counseling makes use of much existing knowledge and skills but applies them with the focus on BBs.

Typically, our approach does not try to boost people's motivation to engage in PA. When the motivation is very strong, all kinds and levels of barriers can be overcome. However, for most people it is not possible to always stay that highly motivated. This means that we as counsellors accept that clients may not have very strong motivations and, therefore, will only engage in PA on the long term when they experience few inhibitions to do so. Some clients, however, may be trapped in a cycle of low energy/motivation to engage in PA that is caused by a low level of PA, and vice versa. They may are not motivated at all to engage in PA. In these clients, the first goal is to induce a minimal motivation by guiding positive experiences of minimal levels of carefully

tailored exercise with personal coaching. To start the process, even extrinsic incentives may be used to generate experiences with PA that eventually should lead to intrinsic motivation. Once the client develops intrinsic motivation, further PA goals may be set taking into account BBs.

The BB approach may not only be used to counsel individuals; its principles may be adapted to fit, for example, a school educational program format. One principle would be to adjust the means and goals concerning PA to what students find feasible. Detected BBs may guide the design of means and goals, possibly for subgroups of students in classes. In addition, student may be educated about self-management by learning to set goals, detect BBs, and handle BBs using (one of) the four BB strategies.

Although the BB counseling in this article is shaped around face-to-face contact, it should also be possible to apply the BB approach through another channel, for example, through the Internet, presented in a Smartphone application (app). Guided questioning on PA goals and on BBs is possible, with individual feedback on accomplishments but also on the power of BBs, and educational texts as well as videos might be applied. Unique features of such an app are that people can use it whenever they want, the potential reach of apps is high (as compared to individual counseling), and that often people have their Smartphone within their reach constantly, even during PA. Research will have to show whether the involvement of the individual with an app is sufficient to lead to actual behavior change.

The barrier-belief approach is evidence based in the sense that most elements it is comprised of are based on theories or empirical evidence. Of course, it is important to test the barrier-belief approach as a full counseling method for PA empirically. To start with, the four BB behavior change strategies might be tested and compared experimentally. Another aspect typical of the present approach is the sequence of the application of the four BB behavior change strategies. Although it seems logical to start with not changing the goal but change the means to reach the goal, and only when this does not work change the goal, it may be that it is evenly effective to start with acceptance of BBs. At the least, the present package of four BB behavior change strategies embedded in a broader counseling procedure should be tested against a control group to prove its effectiveness.

Another aspect that needs further study is the duration of the application of the BB-counseling program. Ideally, the counseling is finished when the client is able to detect BBs and to handle barriers independently of the counsellor. However, in practice the duration of counseling will depend on financial constraints and professional culture. For some clients a continuing care-model may be more appropriate. We hope that the perspective of BBs in combination with the four BB behavior change strategies in PA counseling will inspire practice as well as research. In the end, the broad availability of effective evidence based interventions for PA has the potential to contribute to an increase health and quality of life in all societal segments.

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CHAPTER 5

BARRIER-BELIEF LIFESTYLE COUNSELING TO INCREASE LONG-LASTING PHYSICAL ACTIVITY AND A HEALTHY DIET IN PRIMARY CARE; A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Aim: Intervening on *barrier beliefs* (BBs) may inhibit the role of barriers as mediating factors in lifestyle behavior. The aim of this study was to analyze the effects of a barrier-belief counseling intervention (BBCI) on physical activity (PA) and healthy food intake.

Method: An RCT was conducted in a primary care setting among adults (aged 18-70), with two interventions: a BBCI (n=123) and a standardized lifestyle group intervention (SLI) (n=122). A non-treated hanging control group (n=36) received no intervention. Outcomes on PA (accelerometer and SQUASH) and fruit and vegetable intake (self-report) were measured with follow-ups at 6, 12 and 18 months, and analyzed using multiple regression.

Results: The BBCI was more effective on PA compared with the SLI ($p<.01$): in the short term all PA outcomes improved ($p<.05$), in the long term moderate-to-vigorous PA outcomes improved ($p<.05$), all with small effect sizes. No differences between interventions were found on fruit and vegetable intake. None of the outcomes in the control group changed over time.

Conclusions: BBCI in primary care improves PA compared with SLI.

Practice Implications: The customized BB approach seems promising for implementation in healthcare practice to stimulate PA.

INTRODUCTION

Engaging in regular moderate-to-vigorous physical activity (PA) and a healthy daily diet are both associated with physical and mental well-being[1-3], as well as reduced risk of all-cause mortality from lifestyle-related chronic diseases and premature death[4-7]. However, in Western societies the majority of the population is not sufficiently engaged in PA[8], and a high percentage of people across the world fail to meet recommendations for a healthy diet[9,10].

In general, there is little empirical evidence on effective, theory-based PA interventions for the long term[2,8,11-20]. The Trans Theoretical Model (TTM)[21] is the most frequently applied theoretical model in lifestyle interventions[19] that has proven its efficacy in the short term[21,22,23]. The effectiveness on behavioral change in the long term is still unclear though[18,24-27]. When motivation decreases barriers may become manifest, which may cause relapse into "old behavior". It is thus emphasized that focusing on barriers may be a key factor for sustained long-term behavioral change[28-34].

Many studies have reported on perceived barriers to PA; these were mainly cross-sectional descriptive studies among specific patient, ethnic or age groups. To understand the causes of PA behavior we used Social Cognitive Theory (SCT)[44]. Hence from this perspective, barriers are approached as *beliefs* that obstruct pursuance of a PA goal. In our previous theoretical review we call these *barrier beliefs* (BBs)[32]. These BBs, as social cognitive determinants of PA, refer to people's mental representations of the causes for not initiating PA or of the factors that interfere with their motivation and increase the chances of relapsing from PA.

We found little research on barriers to PA from this perspective, although eight studies examined the relationship between PA and barriers as social cognitive determinants[35-42]. They all reported a reverse association between perceived barriers and engagement in PA. Only one study was found to intervene on barriers to PA, causing an increase in PA. However, this was a one-month, single-arm trial with no long-term follow-ups and a small sample[43]. To our knowledge, the efficacy of addressing perceived barriers to PA has not been previously analyzed for the longer term.

It is expected that people can learn to cope with inhibiting BBs in lifestyle behavior. We developed an intervention with four different BB handling strategies[32], aimed at learning to cope with inhibiting BBs to facilitate long-term PA (Table 1). The BB counseling intervention (BBCI) aimed to accomplish *self-determined* PA and dietary goals, adapted to the motivation of the participant, in order to increase PA and improve healthy food intake. The BBCI surpasses the standardized lifestyle intervention (SLI), which is based on the commonly applied TTM. In the SLI the objective was to increase motivation for specific PA and dietary goals based the American College of Sports' *standards* for moderate PA[45] and Dutch dietary recommendations[61]. The motivational stages of the TTM provided content for phase-specific guidance. The SLI was expected to increase participants' motivation to change PA and diet, causing increase of PA and improvement of dietary behavior in the short term[21-23] (Table 2).

The aim was to analyze effects of the BBCI versus the SLI, each based on different rationales and using different formats (Table 1), on PA and fruit and vegetable intake in adults self-

determined as inactive in a primary healthcare setting. We hypothesized that a BBCI is more effective in increasing PA and fruit and vegetable intake compared with an SLI, and has long-term effects on PA and healthy food intake. All participants were followed up in the longer term, up to 18 months.

Table 1. Developed BB change strategies aimed at PA change

Changing means: the PA goal to be set, is not changed but different handling strategies or means are applied to make the goal-directed behavior more feasible. Thus, clients have to find solutions and take actions - set priorities, reschedule, ask other people, use other clothing, etc. - to stick to their PA goal.
Change goals to change BBs: To lower the investments radically, the PA goal may be changed. A variety of creative alternatives can be discussed, and with each feasible alternative BBs must be checked. This goal-setting approach leads to a PA goal without or with only small barriers. Although the low set goal may have relatively weak effects on health, our premise is that it is better to start small and grow when (the effect of) BBs decrease, than to start high with increased risk for disappointment and relapse.
Restructuring/changing BBs: When BBs cannot be changed by handling them differently and by goal-setting, they must be changed cognitively. That is, BBs may be based on erroneous knowledge based on different sources. The BB may refer to an aversive outcome, or is related to low self-efficacy. Both types are interpretations of what people have observed or have experienced. As in cognitive therapy in general, these beliefs may be challenged in a Socratic dialogue or with experiments. Education may provide the clients with the factual knowledge on the evidence of positive effects of PA.
Accepting the investments demanded by BBs: Sometimes handling cannot be further improved, goals cannot be further adapted, and BBs cannot be restructured. Acceptance means that the investments and costs that come with reaching a goal are not avoided but taken. Acceptance does not remove the factor that might inhibit PA but it lowers or completely removes the inhibiting power of the factor. By discussing the positive and negative sides of lifestyle change, relevant factors may gain or lose value. Mindfulness exercises might learn to just observe the belief with some distance and 'let it go'.

METHOD

Design

We designed a multicenter randomized controlled trial (RCT) in a primary care setting with balanced randomization (1:1) for BBCI and SLI recipients. Separately, a non-treated hanging control group was recruited which received no care (Flow diagram).

Recruitment

Study participants for both intervention groups and the control group were recruited from thirteen primary care centers in eight cities in the northern Netherlands between May 2011 and September 2014. Eligible participants were those self-determined as "inactive" and willing to sign up for a lifestyle intervention. GPs informed eligible patients about the study and the procedure, and referred them to the study. Excluded were individuals with a diagnosis of acute coronary heart disease, stroke, severe hypertension (systolic pressure >180 mmHg or diastolic pressure >120 mmHg), chronic depression or chronic pain. Highly active participants were excluded, i.e. those who reported being moderately active, at >100 min/day.

Table 2: Format of the standardized lifestyle intervention (SLI) and the barrier-belief counseling intervention (BBCI)

	The standardized lifestyle intervention (SLI)	The barrier-belief counseling intervention (BBCI)
Aim	Increase motivation for lifestyle-goals and pursue formulated goals according to health standards	Decrease BBs to accomplish PA goals to pursue self-determined goals
Approach	TTM[21]	BB approach[32]
Content	Phase specific guidance	BB strategies -develop means -change goals -restructure BB -accept the investments and costs demanded by BBs
Communication channel	Group condition (n=3 to 8)	Individual condition
	Interactive presentation	Counseling sessions
Duration	-2x 45-minute individual sessions -5x regular 90-minute group meetings, for six months	-12x 45-minute individual sessions, for 6 months
Intervention protocol	Fixed and structured to TTM	Depending on the starting situation and changing process of the patient
Counseling technique	Directive and uniform	Patient-tailored
Goalsetting	Fixed imposed PA and diet goals according to standards	Self-determined (mini)goals on PA and diet
PA outcome	Performing PA	Breaking through inactivity
Intervening on motivation	Boosting motivation to accomplish PA and diet goals	Installing minimal motivation to accomplish PA and diet goals
Specifically used 'behavioral change techniques'[54,55]	-comparison of behavior -comparison of outcomes -regulation	-barrier identification -self-belief -identity reframing -behavioral experiments -regulation
Generally used 'behavioral change techniques'[54,55]	-behavioral health risk and consequences -social support -goals and planning -learning -self-regulatory strategies, -feedback and monitoring -comparison of behavior	Same as in SLI

In the same period, subjects for the BBCI and SLI were invited to join this study; letters were mailed out randomly to 5,000 households of three general practices. Eligible participants came in contact with the study after the GP invited them to join or in response to the invitation letter. A counselor subsequently contacted them by phone and verbally checked inclusion and exclusion criteria for eligibility. Next, the randomization was conducted. Baseline measures were applied after randomization as starting point for both interventions. The intervention allocation was concealed until after the baseline measurements were completed.

Separately, subjects for the control group-were invited to join this a health measurement for our study, with one follow-up and a lifestyle advice afterwards; letters were mailed out randomly to 5,000 households of two other general practices. The same recruitment procedure was conducted, except the randomization.

Ethics

The study protocol was approved by the medical ethics review board of University Medical Center Groningen(NL30895.042.10)and listed on the ISRCTN registry (ID ISRCTN61991892). All subjects were informed verbally and in writing about the purpose and procedure of the study, and provided written consent to participate and for their data to be used in the study. Participants of the BBCI and SLI were all informed about the existence of both intervention groups (the BBCI and SLI) and the random allocation to the intervention groups. Participants of the non-treated control group were *not* informed about the existence of intervention groups because of the potential intervention effects on a non-treated control group, which appeared in previous research[69,70].

Group assignment

A total of 245 enrolled participants were randomly allocated to the intervention BBCI group (n=123) or the SLI group (n=122) by two researchers, using a computer-generated random numbers sequence, *before* baseline measurements. For participants, the allocation was concealed until *after* all baseline measurements were completed. There was no random allocation to the control group (n=36). Participants and counselors were not informed about the results of the measurements.

Measurements

Data on personal characteristics, PA (SQUASH) and fruit and vegetable intake were obtained the week before baseline. Questionnaires were sent out to participants home addresses and were asked to fill out the week before baseline. At baseline, measurements on weight, length, and accelerometer-instructions were conducted by the counselors at GP practices. The PA measurement with the accelerometer was obtained over a 7-day period directly after baseline measurements and subsequently at each follow-up. All intervention group participants had follow-ups at 6, 12 and 18 months. The control group was only followed up at 6 months. Each follow-up PA and fruit and vegetable intake was measured in the intervention groups and control group.

Personal characteristics

Participants' personal characteristics measured were gender, age, marital status, educational level (*lower/secondary-vocational/higher*) and employment (*yes/no*). Weight and height measurements were obtained and body mass index (BMI) was calculated.

Physical activity assessment

To assess PA, participants wore an accelerometer to analyze time spent on physical activities. For this measurement we used an Actigraph GT3X (Actigraph, Pensacola, FL, USA), which has previously been validated[46]. Accelerometers were placed on the right hip. Participants were instructed to wear the accelerometer for seven consecutive days, and to only remove it while sleeping or in water-related activities (e.g. swimming or bathing). The monitor was set to record PA in a 60s epoch[47]. A valid day was defined as > 10 hours of wear time. A minimum of four valid days was required to be retained in the analysis[48]. Non-wear time was defined as 90 consecutive minutes of 0 cpm, allowing up to a 2-minute interval of counts between 0-200 cpm within 30 consecutive minutes of 0 cpm[49]. PA intensity was determined according to the VM3 cut-off points proposed by Freedson[50]: light intensity (LPA) (0-2689 cpm), moderate intensity (MPA) (2690-6166 cpm), vigorous intensity (VPA) (6167-9642 cpm) and very vigorous intensity (VVPA) (>9643 cpm). Moderate-to-vigorous intensity PA (MVPA) is a commonly used term for PA with an intensity >2690 cpm. Sedentary behavior (Sed) was defined as >10 minutes of <99 cpm. Algorithms, using VM3 data, were available in ActiLife software version 6.9.5.

Subjective PA was measured using the Short Questionnaire to Assess Health-enhancing PA (SQUASH[51]). The questionnaire obtained participants' level of commuting, and leisure-time and sports, household and work-and-school activities. The total activity scores on the SQUASH are considered to be sufficiently reliable and valid to measure the PA level of a healthy adult population[52].

Fruit and vegetable intake

To measure healthy food intake, servings of fruit and vegetables were measured. Fruit and vegetable consumption was assessed by a self-report on servings (frequency and portion) of fruit and vegetables during an average week (Figure A), inspired on a validated food-frequency questionnaire[53] with a commonly applied format to measure healthy food intake: portion at a time and number of days per week. An index score was calculated by taking the sum of servings of vegetables and fruit.

Implementation of interventions

Implementation of the BBCI and SLI was conducted at GP practices. There were no charges for the physicians or the participants. The interventions were performed by a total of 25 counselors, specifically trained in counseling for the BB approach and the group intervention, and were provided and supervised by Hanze University Groningen. Both interventions were implemented by the same counselors, to ensure the therapist effect was the same.

Prior to implementation, assessor-counselors followed an intensive training consisting of 10 two-hour sessions and a practical exam. They also joined supervision sessions for guidance with the counseling process, led by two trained lecturers/researchers. Contamination between interventions was prevented by a distinguished description of treatment principles for each intervention. In the SLI the context and order of sessions were determined in detail beforehand.

The BBCI had treatment principles to apply behavioral change techniques, depending on the patient's needs.

Standardized Lifestyle group Intervention (SLI)

In this group intervention the objective was to increase the motivation for specific lifestyle goals and to pursue PA and dietary standards (Table 1). The defined motivational stages of the TTM provided the content and tools for guidance to the next stage. In each session the intervention made a one-phase progress from the TTM, starting from pre-contemplation to action stage[60]. In the first group session (for the pre-contemplation phase) transfer of knowledge about PA, a healthy diet and risk perceptions were central. Session 2 (for the contemplation phase) focused on discussing the advantages and disadvantages of becoming more active and dietary change. In session 3 (for the preparation phase) goals were set. Boundaries were expanded in session 4, and session 5 discussed dealing with relapse.

This intervention was not customized to the individual participant; at the group level all participants were treated as if they were all in the same phase. Participants had to accomplish goals of maintaining at least 30 minutes/day of PA[45] and/or eating healthier by following dietary standards[61].

A group approach was chosen, as structured group interventions are considered state-of-the-art in lifestyle programs in the Netherlands[62-64]. This approach offers important opportunities for group support from peers as well as guidance and reinforcing feedback from a group leader[67,68]. A directive way of using standards and goal-setting in this group approach is commonly applied in practice[65,66]. The content of this group intervention is described in Table 2.

Barrier beliefs Counseling Intervention (BBCI)

This individual intervention aims to lower existing BBs to PA in order to accomplish PA goals, pursuing self-determined goals for PA and diet adapted to the motivation of the patient (which is often weak). Patients will learn to cope with those BBs that may inhibit PA now or in the future.

BBs are addressed using four different BB behavioral change strategies, which can be implemented in combination: 1. design means to reach the goal; 2. change goals to change BBs; 3. restructure/change BBs, and 4. accept the investments and costs demanded by BBs.

Central aspect of this individual BB approach were the exploration of BBs toward PA, one's personal situation, and an assessment of the changeability of the BBs. The counseling was customized to participants' needs to develop an individual pattern of PA and diet for the longer term. For a complete description of the BBCI see Bouma et al., 2014[32].

In BB coaching the goal was to stimulate participants to engage in a minimum level of PA during the day in order to decrease inactivity. Setting mini-goals has been proven to benefit health effects and lead to more lasting changes than setting high goals[56,57,58,59]. Existing standards for PA and diet were released. The contents of both interventions are compared in Tables 1 and 2.

Control group

Participants in the non-treated control group were given no intervention. Two time measures were included. Because of an expected intervention effects on a non-treated control group, which appears in previous research, the control group was not included in the randomization[69,70].

Sample size

The outcome measure was the amount of time a participant spent on PA (in minutes). Although our focus was on the accelerometer data in the operationalization of PA, the SQUASH data was chosen for sample size calculation because of its more conservative character on changes compared to an accelerometer[71]. For sample size calculation, a yielded improvement of 70 minutes/week (10 minutes/day extra PA) was assumed, with a standard deviation of 130 at 18 months post-randomization based on previous studies[8,15] and considered as a clinically relevant improvement. Power and Sample Size Calculations (Statistical Solutions LLC) showed that by demanding a statistical power of .80, $\alpha = .05$ and Cohen's d effect size = 0.7, 73 subjects should be included in each arm. To compensate for potential loss of participants, we intended to recruit at least 100 subjects.

Statistical methods

We conducted an all-cases analysis, including all participants with a baseline measurement. Four measurements per subject were conducted using multi-level regression analysis. Time and group interaction effects were assessed using mixed-model analysis. Group differences at each time point were assessed by pairwise comparison using general linear models with repeated measures. Additionally, because of the high dropout rate, we conducted an imputed intention-to-treat analysis. These analyses were conducted to predict the missing values of all participants who started at baseline, and were used to make a comparison between the trends of the all-cases analyses and the imputed analyses. All missing data from baseline and follow-up measurements were imputed with predictive mean matching method. Imputed data are show in the figures (2a-e) and in a Table A. in the appendix.

Gender, age, education and BMI were included in the analysis as confounders. Analyses were controlled for baseline measurements on PA and fruit and vegetable intake. A p-value < 0.05 was considered statistically significant. We calculated a statistical index of effect size (es) relative to baseline, according to Cohen's criteria[73]. The cut-off values used were: very small < .2; small .2 to .5; moderate .5 to .8; large: > .8.

RESULTS

A total of 306 subjects gave written consent, after which 61 individuals were excluded by the counselor: 25 did not meet the inclusion criteria and 36 declined to participate. In total, 245 individuals were randomized to the BBCI (123) or the SLI (122); 10 BBCI and 31 SLI participants withdrew before baseline. At baseline we measured 113 BBCI and 91 SLI participants, after baseline 16 BBCI and 14 SLI participants withdrew. Finally, 97 participants started in the BBCI and 77 in the SLI. The 18-month follow-up was completed by 63 BBCI and 60 SLI participants (41%). Additionally, 38 participants were signed to the control group of which 36 were measured at baseline. The six-month follow-up was completed by 32 participants (Figure 1).

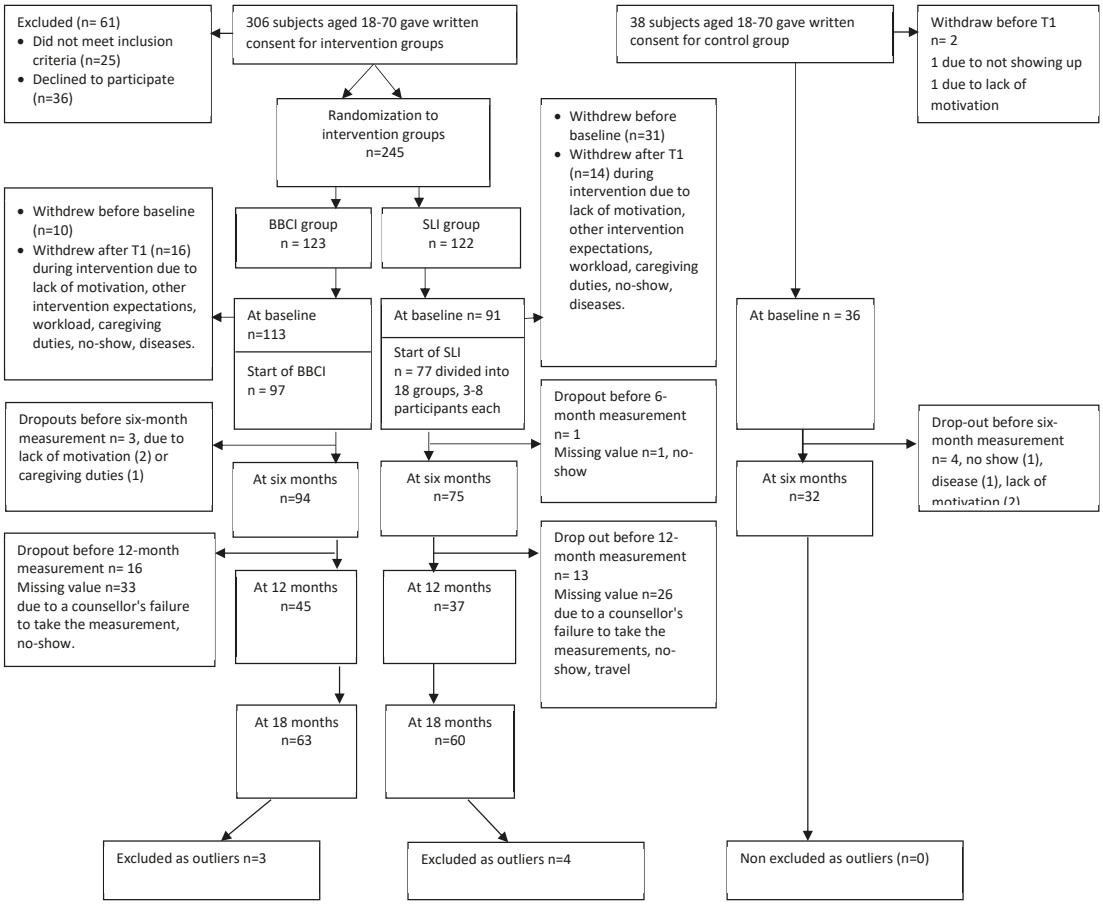

Figure 1. Participants' flow diagram

Outcomes and estimations

Mean age of the study population was 50, and 59% were female (Table 3). In this group 15% were "normally weighed", defined as BMI < 25; 30% of subjects were overweight, defined as BMI ≥ 25 to < 30; and 50% were obese, defined as BMI ≥ 30. At baseline, 45% of the study population performed PA less than 30 minutes/day; All means and comparisons from baseline to 18 months are shown in Table 3, 4 and Figure 2a-e.

Table 3: Baseline characteristics of participants from the BBCI and SLI

	All participants n=240* (%)	Mean (SD)	BBCI n=113* (%)	SLI n=91* (%)	Control group n=36 (%)
Gender					
Male	92 (38)		43 (39)	36 (40)	13 (36)
Female	142 (59)		67 (61)	54 (60)	21 (58)
Age		50 (12)	50 (12)	51 (12)	50 (15)
Marital status					♦
Married	115 (48)		56 (51)	48 (53)	11 (31)
Not married	46 (19)		20 (18)	13 (14)	13 (36)
Cohabiting	17 (7)		7 (6)	8 (9)	2 (6)
Other	24 (10)		14 (13)	5 (6)	5 (14)
Educational level					
Higher education	50 (21)		20 (18)	11 (12)	7 (19)
Secondary-vocational education	106 (44)		44 (40)	45 (50)	17 (47)
Lower education	59 (25)		33 (30)	19 (21)	6 (17)
Employment					
Yes	130 (54)		63 (57)	51 (57)	16 (44)
No	78 (33)		35 (32)	27 (30)	16 (44)
Presence of overweight or obesity					
Fraction with BMI < 25	36 (15)	22.7 (1.6)	15 (23)	9 (23)	12 (33)
Fraction with BMI ≥25 - < 30	71 (30)	32.5 (5.3)	29 (26)	25 (27)	17♦ (47)
Fraction with BMI ≥30	119 (50)	35.5 (4.3)	63 (57)	49 (54)	7♦ (19)
Exercise, MVPA min/day					
<30 min	106 (44)	17.6 (7.2)	46 (41)	47 (52)	13 (36)
30-60 min	67 (28)	42.5 (8.7)	28 (25)	24 (26)	15 (42)
>60 min	31 (13)	75.8 (15.5)	20 (18)	6 (7)	5 (14)

*) in case of less than n in frequencies, cases were missing. ♦) significant difference across group on baseline measurement ≤ .05.

Table 4: All-cases analysis of means and comparisons from baseline to 18 months in the randomized controlled trial (differences between interventions groups BBCI and SLI and control group)

		BBCI				SLI				Control group			Repeated measures, pairwise comparison, P-value			Mixed Models, model effects, P-value		
	Follow-up, months	n▲	Mean	SD	ES	n	Mean	SD	ES	n	Mean	SD	BBCI-SLI	BBCI-Control group	SLI – Control group	Time	Group	Time* Group inter-action
MVPA	0	94	37.70	24.6		77	30.68	21.67		33	35.95	18.97	.052	.997	.098	.391	.000	.005
	6	79	44.49*	25.42	.27	66	29.51	14.56	-.06	27	32.97	19.66	.000	.048	.338			
	12	49	40.68*	19.82	.13	26	31.64	20.31	.05				.085					
	18	57	41.47*	21.25	.15	47	25.97*	12.24	-.27				.000					
LPA	0	94	464.66	120.40		77	446.58	111.74		33	454.55	99.57	.226	.589	.638	.205	.089	.050
	6	79	506.50*	112.64	.94	66	463.18*	120.50	.14	27	426.56*	128.44	.039	.011	.303			
	12	49	448.00	116.40	-.05	26	447.99	118.23	.01				.807					
	18	57	471.77	133.12	.02	47	443.76	118.24	.02				.162					
Sed	0	94	380.17	142.48		77	377.98	123.21		33	390.63	84.25	.728	.831	.564	.002	.310	.028
	6	79	326.36*	124.40	.40	66	369.43	123.20	-.07	27	410.08	118.22	.140	.127	.701			
	12	49	370.99	115.17	.07	26	383.91	112.70	-.12				.803					
	18	57	364.90	138.70	.11	47	392.57	131.16	.18				.402					
SQUASH activity scores	0	104	5144	3617		84	4030	3944		32	4279	2754	.260	.020	.969	.759	.001	.676
	6	90	6032*	4275	.22	67	4418	3100	.11	31	4085	3418	.022	.000	.209			
	12	55	5493	3199	.10	34	4093	3159	.02				.151					
	18	54	5226	3337	.02	44	4473	3548	.12				.602					
Fruit and vegetable intake	0	102	20.10	8.98		82	19.04	8.91		31	19.77	11.60	.603	.809	.372	<.001	.080	.478
	6	86	23.23*	9.23	.34	65	22.06*	9.24	.33	31	20.56*	11.34	.455	.001	.171			
	12	54	21.48	8.23	.16	31	19.32	8.72	.03				.319					
	18	52	26.62*	11.42	.63	44	22.47*	9.32	.38				.108					

▲) in case of less than n in frequencies, cases were missing; Abbreviations: MVPA, average time per day spent on moderate-to-vigorous physical activity; LPA, average time per day spent on light physical activity; Sed, average time per day spent on sedentary behavior; SQUASH activity scores, total activity score of the SQUASH; Fruit and vegetable intake, index score of servings of fruit and vegetable; *) within-group significance of difference compared with baseline measurement ≤ .05; Effect size relative to baseline, according to Cohen's criteria (Cohen, 1988): trivial, < .2; small, .2 to .5; moderate .5 to .8; large, > .8. Data are given as estimated margin means derived from mixed-model analysis. P-values for group differences at each time point were assessed by pairwise comparison using general linear models with repeated measures. P-values for effects between time*group interaction effect were assessed using mixed-model analysis.

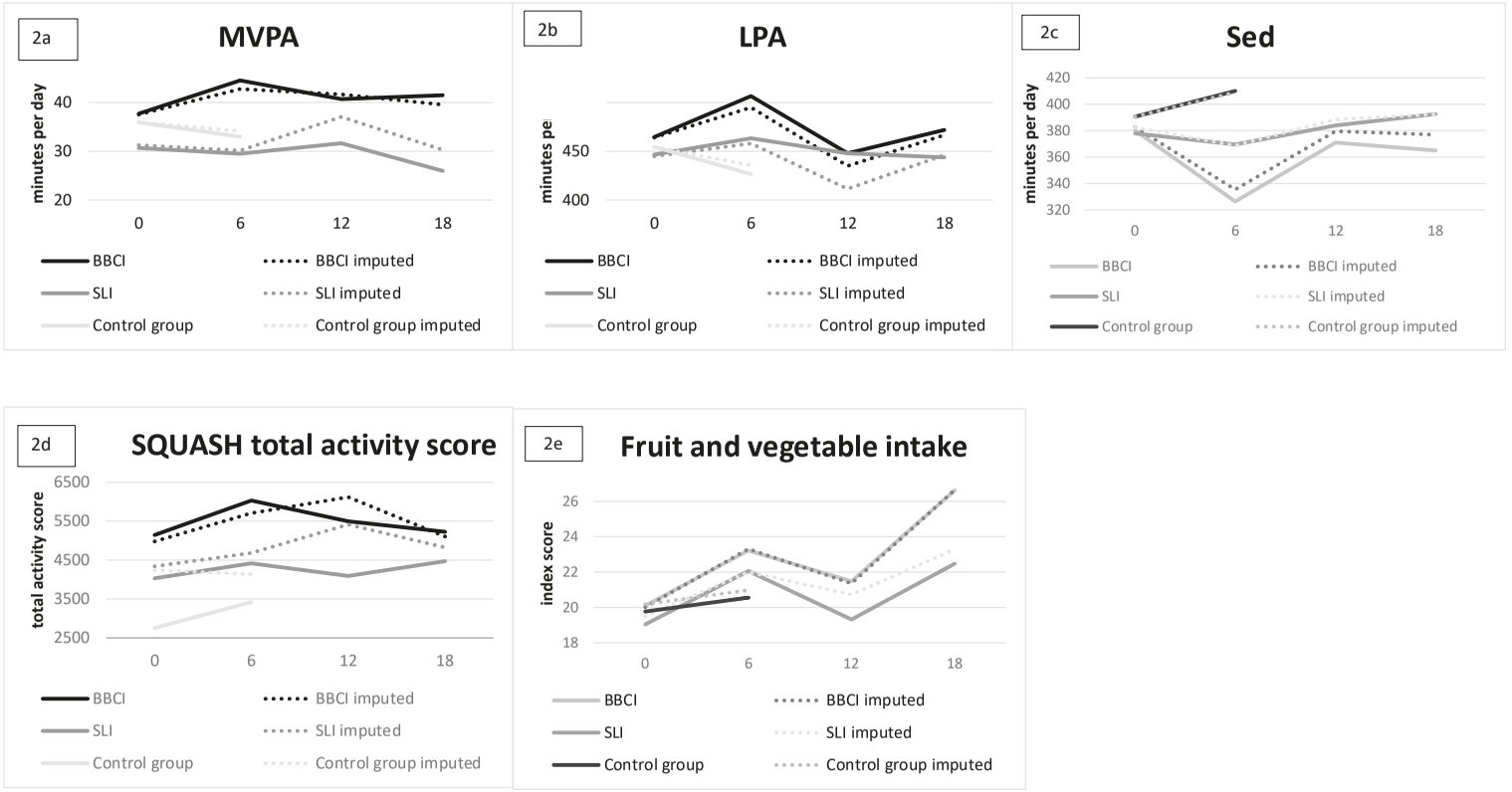

Figure 2a-e: All-cases analysis combined with the intention-to-treat analysis with imputed data of means from baseline to 18 months in the randomized controlled trial.

Confounders

The fixed effects on the dependent variables of gender, age and BMI, included in the analysis as confounders, are shown in Table 5.

Table 5: Fixed effects of factors included in the analysis as confounders.

Fixed effects	Confounders			
Dependent variable	**Gender**	**Age**	**Gender*Age**	**BMI**
Sedentary behavior	.667	.075	.784	.254
Light PA	.559	.318	.277	.097
Moderate to vigorous PA	.746	.103	.680	.527
SQUASH total activity score	.002*	.001*	.001*	.894
Fruit and vegetable intake	.931	.001*	.529	.660
Body mass index	.004*	.122	.020*	-

*) significant effect of the factor on the depend variable

Physical activity (PA)

Accelerometer: Baseline scores on MVPA, LPA and Sed did not differ significantly between the two intervention groups and the non-treated control group (Figures 2a, b, c & Table 4). There were significant interaction effects between time and group for moderate-to-vigorous intensity PA (MVPA) (p<.01), light-intensity PA (LPA) (p=.05) and sedentary behavior (Sed) (p=.028). In the BBCI PA increased significantly during the six-month intervention and the additional 12-month follow-ups.

Compared to baseline, the BBCI saw increased MVPA at 6, 12 and 18 months follow-up (p< .05); effect size calculations showed small-to-very small effects. Compared to baseline, the BBCI increased on LPA at 6 months follow-up (p< .05), with a large effect size. Sed decreased in the BBCI at 6 months follow-up compared to baseline (p< .05), with a small effect size.

In the SLI group MVPA decreased at 18 months follow-up (p< .05) compared to baseline, with a small effect size, and LPA and increased on Sed. Compared to baseline, the SLI showed higher LPA at 6 months follow-up (p< .05), with a small effect size. Compared to baseline, the SLI showed increased Sed at 12 and 18 months follow-up, but results were not significant.

In the non-treated control group LPA decreased significantly over six months. In the control group, at 6 months follow-up, there were no significant changes on MVPA, LPA and Sed.

SQUASH: Baseline scores on SQUASH activity scores did not differ significantly between the two intervention groups and the non-treated control group (Figure 2d, Table 4). There were significant group effects for SQUASH scores (p<.01), accounted for by the higher scores in the BBCI. Compared to baseline, the BBCI increased in SQUASH scores at 6 months follow-up (p< .05), with effect size calculations showing a small effect.

Compared to baseline, the SLI increased SQUASH scores at 6, 12 and 18 months follow-up (p< .05), but outcomes were non-significant. Differences between BBCI and SLI on total activity score at 6 months follow-up were significant (p<.05).

In the non-treated control group, at 6 months follow-up, there was no significant change.

Fruit and vegetable intake

Baseline scores on fruit and vegetable intake did not differ significantly between the two intervention groups and the non-treated control group (Figure 2e, Table 4). The interaction between time and group was not significant, suggesting that none of the interventions led to a stronger increase then the other. There was, however, a significant time effect for fruit and vegetable intake ($p<.01$), indicating improvements in both intervention groups and the control group. Compared to baseline, the BBCI showed increased fruit and vegetable intake at 6 and 18 months follow-up ($p<.05$), and effect size calculations showed a moderate effect. Compared to baseline, the SLI showed increased fruit and vegetable intake at 6 and 18 months follow-up ($p<.05$), with moderate effect sizes. The non-treated control group improved significantly over six months ($p<.05$), yet the effect size was small.

DISCUSSION

The barrier-belief counseling intervention (BBCI) in primary care turned out to be more effective, especially in changing PA, compared with a standardized lifestyle intervention (SLI). This barrier-belief (BB) approach was described, which differs in several ways from an SLI. Most importantly, instead of focusing on the results, the BBCI focused on beliefs that might inhibit PA; this is reflected in the change strategies. First, BBs can be related specifically to how people try to reach their goals. Changing a routine, may be the solution that leads to fewer negative outcomes. Hence creative solutions can help change BBs. Second, BBs can be related to the investment demanded to achieve a PA goal. In this case it might be better to change the goal (to make the BB irrelevant). This is the mechanism behind setting "mini-goals". Third, BBs can depend on erroneous knowledge. In this case the counselor will aim to change the patient's perceptions. Fourth, sometimes barriers might be accepted; this does not remove the factor that might inhibit PA, but it lowers or completely removes the inhibiting power of the factor.

The results of this study show that, due to the BBCI, all PA outcomes improved significantly in the short term. In the longer term moderate-to-vigorous PA outcomes improved significantly. None of the outcomes in the non-treated control group changed significantly over time, except: outcomes on diet and LPA, with (very) small effect sizes. However, comparing outcomes of the intervention groups with those in the control group must be done with utmost caution. The observed results in the control group should be interpreted as quasi-experimental effects, because it lacked random assignment. This means that the participants in the control condition may differ on important but not measured variables. Future research still has to show that the participants in the BBCI and the SLI undergo more improvements than participants who have not been exposed to any intervention.

Results of the BBCI were in line with the expectation that by lowering the inhibiting effect of specific dominant BBs engagement in PA would be stimulated. This is in accordance with previous research, which demonstrates that a reduction in negative perceptions on PA (related

to self-efficacy and outcome expectations) would yield an increase in exercise and suggests that interventions targeting social cognitive constructs could increase activity level[35-41].

Relatively more barriers are expected to be endorsed by improving PA at moderate-to-vigorous intensity levels than when improving low-intensity activities or sedentary behavior, due to the higher costs of performing PA at higher intensity levels. This involves the investment costs of engaging in a difficult task (self-efficacy-related) or coping with an aversive experience (negative outcome expectations-related)[74]. The results of this study show that in the longer term the effects of handling BBs with BB counseling may be more lasting in moderate-to-vigorous PA than on light PA.

Both interventions turned out to be effective on fruit and vegetable intake in the short and the long term, and no differences were found in effects between intervention groups. Apparently the pursuance of healthy food goals itself is effective on the intake, apart from the change strategy. This might be the reason why the BBCI is effective on PA but not particularly on fruit and vegetable intake.

According to the World Health Organization, the primary healthcare setting can contribute essentially to stimulate a healthy lifestyle[75], as most of the general population in the West is served in that sector[76]. GPs should discuss PA as a treatment option with their patients. GPs could refer eligible patients systematically to lifestyle interventions[76,77]. For future implementation in primary care, healthcare professionals (e.g. GPs, certified nurse practitioners, lifestyle coaches) could be equipped with training resources to discuss BB with their patients, before or as an alternative to outside referral. For effective lifestyle management we recommend a cooperation between allied healthcare professionals and GPs in clinical practice[78] who should be trained to routinely implement lifestyle interventions[79,80]. This BB method, with its customized treatment, seems an appropriate intervention to increase patients' PA.

Strengths and weaknesses

Although we reported positive results for the primary-care-based BB counseling method, which recruited a large sample and was followed up for 18 months, there are limitations. We must be cautious about the effectiveness of the BB approach, for various reasons. A "package strategy" was conducted in both interventions which included different behavioral change techniques. This makes it complex to pinpoint the exact source of the interventions' efficacy. The efficacy of different techniques within the BBCI on health behavior should be explored further in modeling experiments, where elements of an intervention are manipulated[81]. Additionally, there was a difference on medium (individual vs group) and frequency of sessions; the total contact time was about the same. The fact that the BBCI was administered individually may have had effects on the outcomes. On the other hand, group peer processes are advantages of group over individual approaches. Group interventions are very common in counseling and are seen as state-of-the-art in lifestyle programs[62-64]. A group approach was therefore chosen as a strong control group.

The deficit of data at the follow-ups may have caused a distortion of the trend. All missing data from baseline and follow-up measurements were imputed with predictive mean matching

method[72]. The outcomes show that the magnitude of improvements in the all-cases analyses were similar to the results of the imputed analysis: no significant differences were found between trends. It may therefore be concluded that missing data did not have a significant effect on outcomes (Figure 2a-e, Appendix Table).

Noticeable is the substantial group of overweight and obese participants (23% BMI>25; 55% BMI>30), although this was not a selection criterion. It may be that GPs mainly refer patients on easily assessable indicators such as overweight and lifestyle-related diseases[62]. This may have led to an overrepresentation of overweight participants in the study. Additionally, the average MVPA of study participants was rather high, with 33 min of MVPA per day (min 3; max 88; SD 20). A reason may be that no objective measure was used as cut-off point in the screening. Eligible participants were self-determined as "inactive". Also, participants recruited by their GP turned out to be motivated to change PA behavior, and may have started to exercise before baseline. Previous research has shown that unmotivated persons are referred by GPs less often[77].

The control group was not optimal for several reasons. First, while both the BBCI and the SLI groups were recruited from general practice offices, selected by GPs, and the participants were randomly assigned to one of the interventions, the control group was recruited separately from the community at large only, not involving GP selection. Possibly because of this difference in recruiting, the control group showed significant baseline differences on BMI and activity level with the intervention groups. Therefore, the statistical analyses were controlled for BMI and PA baseline measures. Second, because the inclusion of participants in the control group took much time and effort, the group was relatively small. Third, both intervention groups were follow-up at 6, 12 and 18 months, while the control group was only followed up at 6 months. Thus, effects of the control group may not be comparable optimally and should be interpreted as quasi experimental.

The intervention group allocation occurred before baseline measurements and could have led to bias on the BMI measurement and the accelerometer-instruction.

Conclusion

This study confirms the assumption that intervening on barrier beliefs with a customized treatment is an effective procedure to stimulate PA implementation in healthcare practice. Trends are evident, although one must be careful in generalizing the trial findings to a general population.

Practice Implications

The BBs approach develops a way of counseling for the central construct of barrier beliefs to stimulate independent engagement in PA in the longer term. These four BB behavioral change strategies in PA counseling may inspire healthcare providers' practices as well as research on PA incentives, possibly contributing to further increase health and prevent lifestyle-related illnesses. The next step would be to further investigate the efficacy of different elements within the BBCI on health behavior in order to maximize intervention impact and refine strategies.

Informed consent and patient details:
I confirm that all patient identifiers have been removed or disguised so that the patients described are not identifiable and cannot be identified through the details of the story.

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Table A. Appendix: Intention-to-treat analysis of means and comparisons from baseline to 18 months in the randomized controlled trial (differences between imputed data of intervention groups BBCI, SLI and control)

		BBCI group				SLI group				Control group		
	Follow-up	n	Mean	SD	ES	n	Mean	SD	ES	n	Mean	SD
MVPA	0	109	37.52	24.50		87	31.26	21.75		33	35.95	18.97
	6	109	42.76*▲	26.07	.21	87	30.16	15.92	-.06	33	34.13	19.40
	12	109	41.67*	20.97	.18	87	37.05*	21.64	.27			
	18	109	39.53*▲	24.41	.08	87	30.28	20.46	-.05			
LPA	0	109	464.13	118.71		87	444.75	112.74		33	454.55	99.57
	6	109	494.94* ▪	118.09	.26	87	458.07*	123.34	.11	33	435.57*	125.47
	12	109	435.08*	140.92	-.22	87	411.54*	151.42	.25			
	18	109	466.57	132.77	.02	87	446.06	126.19	.01			
Sed	0	109	382.71	138.18		87	382.56	124.59		33	390.63	84.25
	6	109	335.42*	122.05	.36	87	368.64	123.13	.11	33	409.12	115.23
	12	109	379.54*	128.17	.02	87	388.51*	127.83	-.05			
	18	109	377.03*	140.00	.04	87	392.38*	136.91	-.08			
SQUASH activity scores	0	109	4975	3737		87	4341	3924		33	4239	2794
	6	109	5704*	4280	.18	87	4680	3645	-.09	33	4133	3511
	12	109	6117*	3962	.30	87	5410	3932	.27			
	18	109	5104	3584	.04	87	4821	3638	-.13			
Fruit and vegetable intake	0	104	20.01	8.98		87	19.51	8.92		32	20.18	11.60
	6	88	23.31*	9.23	.36	67	22.00	9.24	.27	31	20.98	11.34
	12	54	21.36	8.23	.16	34	20.73	8.72	.14			
	18	53	26.65	11.42	.65	44	23.29	9.32	.41			

*) within-group significance of difference with t1 ≤ .0; ▲significance of difference with SLI at the same follow-up moment ≤ .05; ▪ significance of difference with control group at the same follow-up moment ≤ .05.

Servings of vegetables
How many days a week do you eat steamed or roasted vegetables, salad or raw vegetables? *less than 1 (0); 1 (1)* to *more than 5 (6)*

On the days that you eat vegetables or salad, how many spoonfuls of vegetables or salad do you eat per day? *less than 1 (0); 1 (1)* to *more than 5 (6)*

Fruit consumption
How many days a week do you eat at least two pieces of fruit? *less than 1 (0); 1 (1)* to *more than 5 (6)*

Figure A. Appendix: Assessment on fruit and vegetable intake with a self-report on fruit consumption and servings of vegetables on an average week.

CHAPTER 6

THE IMPACT OF BARRIER BELIEFS ON PHYSICAL ACTIVITY AND QUALITY OF LIFE; A PROCESS ANALYSIS

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ABSTRACT

Aim: To investigate the effects of a barrier-belief counseling intervention (BBCI) on existing physical activity (PA) inhibiting barrier beliefs (BBs), and the impact of a change in BBs on PA and quality of life (QOL).

Method: An 18-month multicenter randomized controlled trial (RCT) was conducted with an intervention group (BBCI; N=113) and a standardized lifestyle intervention group (SLI; N=91) in thirteen general practitioner practices in the north of the Netherlands in primary care patients (aged 18-70), self-determined as 'inactive' and willing to sign up for a PA intervention. The individual 6-month BBCI included four BB behavior change strategies, aimed at coping with inhibiting BBs. The 6-month SLI, based on the Trans Theoretical Model, included motivational and goalsetting strategies, using PA-standards to accomplish PA-goals. Changes in BBs (62-item BB survey), PA (accelerometer and SQUASH questionnaire) and QOL (EORTC QLQ-C30; LASA; Cantril's Ladder) were measured at baseline and at 6, 12 and 18 months. Intervention effects on BBs were analyzed using multiple regression analyses. The impact of changes in BBs on PA and QOL were assessed with multilevel analyses.

Results: The BBCI was more effective than the SLI in decreasing BBs, as mediating factors in PA and QOL ($p<.01$).

Conclusion: The BBCI decreases BBs to PA, and change in BBs supports PA and QOL in the longer term.

INTRODUCTION

Physical inactivity is a modifiable risk factor for many lifestyle-related chronic diseases and premature death[1-5]. The beneficial effects of adequate and regular physical activity (PA) on physical and mental well-being are generally accepted[6-10]. Health-related quality of life (QOL) appraises the patient's physical, mental, and social well-being. Individuals with chronic diseases associated to lifestyle behaviors, such as diabetes type 2, and other cardiovascular risk factors, report diminished wellbeing and QOL[11,12], whereas being more active is associated with a higher QOL[13,14].

Despite the widespread acceptance of the benefits of being active, in Western societies the majority of the population is not sufficiently active[15,16]. Lifestyle counseling is recognized as appropriate intervention for PA promotion[17-19]. The Trans Theoretical Model is the most frequently applied theoretical model on which motivational lifestyle interventions have been developed. These interventions only showed efficacy in the short term, only during the period in which the intervention was implemented[20-23]. An explanation for these limited effects appears to be that the interventions are designed to strengthen the personal motivation for a specific goal, whereas rresearch shows that it is not easy to maintain motivation in the long term[24,25]. As long as motivating stimuli are present - such as regular contact with a counselor - people may continue investing in their PA goals. When these stimuli disappear, for example after the intervention has ended, barriers become manifest and people relapse. Studies showed that interventions including a focus on barriers related to engaging in PA, could be key for sustained behavioral change[26-29].

From a social cognitive perspective and in the context of this study, we defined barriers as *thoughts* or *verbalized experiences* of a person about obstructing factors for PA[30]. From this perspective barriers are *beliefs* that stand in the way of engaging in, and staying engaged in PA[29,31,32]. Beliefs obstructing the pursuance of a PA goal can be described as *barrier beliefs* (BBs)[33]. BBs refer to someone's mental representation of the causes for not initiating PA, or relapse from PA. They are *attributions* about what is obstructing one's PA behavior[33]. Two main types of BBs can be distinguished: 1) negative self-efficacy expectations, referring to a judgement of a low personal ability to deliver a specific task in performing PA, and 2) negative outcome expectations, referring to the expected occurrence of aversive or undesired effects of PA behavior[34,35]. Positive self-efficacy beliefs and positive outcome expectations determine one's *motivation* to perform PA[35]. To date, a handful of studies have investigated social cognitive determinants of PA among healthy and lifestyle related diseased adults, and results were found that perceived barriers are consistently related to not engaging in PA[29,31,32,36-40].

In this study it is assumed that BBs are inversely related to PA behavior; they inhibit such behavior. The stronger BBs are present, the less people are inclined to invest in PA, and the more negative beliefs exist on one's control over PA tasks. Consistent with this view, people can learn to cope with inhibiting BBs during counseling. Research suggests that counseling on how to cope with barriers may be useful to stimulate long term changes in PA[41]. To our knowledge,

intervening on inhibiting BBs in their role as mediating factors for PA, has not been studied yet. Only one study was found in which an intervention on perceived barriers to PA caused an increase of PA. However, this was a 1-month, single arm trial, without long term follow-up, and with a small sample size in a group of African-American women[42].

We developed an intervention with four different BB handling strategies[33], aimed at learning to cope with inhibiting BBs to facilitate long term PA (Table 1). The BB intervention aimed to decrease existing BBs to PA in order to accomplish *self-determined* PA goals, adapted to the motivation of the patient. The BB intervention surpasses the standardized lifestyle intervention (SLI), which is based on the commonly applied Trans Theoretical Model (TTM)[23]. In the SLI the objective was to increase motivation for specific PA goals based the American College of Sports' *standards* for moderate PA[44] . The motivational stages of the TTM provided content for phase specific guidance. It was expected that the SLI would increase participants' motivation to PA, causing a decrease in existing BBs to PA on the short term[20-23,24,29,61,62] (Table 2).

We designed a randomized clinical trial (RCT) to compare the effects of the BB counseling intervention (BBCI) with self-determined PA goals versus the SLI with health standards PA goals on BBs in adults, self-determined as inactive, in a primary healthcare setting (Table 2). We hypothesized that the BBCI is more effective in decreasing BBs compared to SLI, and has long term effects on BBs. Secondly, it was hypothesized that a decrease in BBs would lead to increased PA and QOL and a decrease in sedentary behavior across an 18 month follow up period.

Table 1. Developed BB change strategies aimed at PA change

Changing means: the PA goal to be set, is not changed but different handling strategies or means are applied to make the goal-directed behavior more feasible. Thus, clients have to find solutions and take actions - set priorities, reschedule, ask other people, use other clothing, etc. - to stick to their PA goal.

Change goals to change BBs: To lower the investments radically, the PA goal may be changed. A variety of creative alternatives can be discussed, and with each feasible alternative BBs must be checked. This goal-setting approach leads to a PA goal without or with only small barriers. Although the low set goal may have relatively weak effects on health, our premise is that it is better to start small and grow when (the effect of) BBs decrease, than to start high with increased risk for disappointment and relapse.

Restructuring/changing BBs: When BBs cannot be changed by handling them differently and by goal-setting, they must be changed cognitively. That is, BBs may be based on erroneous knowledge based on different sources. The BB may refer to an aversive outcome, or is related to low self-efficacy. Both types are interpretations of what people have observed or have experienced. As in cognitive therapy in general, these beliefs may be challenged in a Socratic dialogue or with experiments. Education may provide the clients with the factual knowledge on the evidence of positive effects of PA.

Accepting the investments demanded by BBs: Sometimes handling cannot be further improved, goals cannot be further adapted, and BBs cannot be restructured. Acceptance means that the investments and costs that come with reaching a goal are not avoided but taken. Acceptance does not remove the factor that might inhibit PA but it lowers or completely removes the inhibiting power of the factor. By discussing the positive and negative sides of lifestyle change, relevant factors may gain or lose value. Mindfulness exercises might learn to just observe the belief with some distance and 'let it go'.

Table 2: Format of the standardized lifestyle intervention (SLI) and the barrier-belief counseling intervention (BBCI)

	The standardized lifestyle intervention (SLI)	**The barrier-belief counseling intervention (BBCI)**
Aim	Increase motivation for lifestyle-goals and pursue formulated goals according to health standards	Decrease BBs to accomplish PA goals to pursue self-determined goals
Approach	TTM [22,23]	BB approach [33]
Content	Phase specific guidance	BB strategies -develop means -change goals -restructure BB -accept the investments and costs demanded by BBs
Communication channel	Group condition (n=3 to 8) Interactive presentation	Individual condition Counseling sessions
Duration	-2x 45-minute individual sessions -5x regular 90-minute group meetings, for six months	-12x 45-minute individual sessions, for 6 months
Intervention protocol	Fixed and structured to TTM	Depending on the starting situation and changing process of the patient
Counseling technique	Directive and uniform	Patient-tailored
Goalsetting	Fixed imposed PA and diet goals according to standards	Self-determined (mini)goals on PA and diet
PA outcome	Performing PA	Breaking through inactivity
Intervening on motivation	Boosting motivation to accomplish PA and diet goals	Installing minimal motivation to accomplish PA and diet goals
Specifically used 'behavioral change techniques'[63,64]	-comparison of behavior -comparison of outcomes -regulation	-barrier identification -self-belief -identity reframing -behavioral experiments -regulation
Generally used 'behavioral change techniques'[63,64]	-behavioral health risk and consequences -social support -goals and planning -learning -self-regulatory strategies, -feedback and monitoring -comparison of behavior	Same as in SLI

METHOD

Study design

A complete description of the RCT of the BB counseling intervention (BBCI) has been described elsewhere[43], aimed at analysing the effects of the BBCI on changes in PA, as primary outcome. The study protocol was approved by the medical ethics review board of the University Medical Center Groningen, where the trial protocol can be assessed (NL30895.042.10). The study is listed on the ISRCTN registry under study ID ISRCTN61991892. In brief, the study was an 18-month RCT in a primary care setting with a control group receiving 6 months SLI, and an intervention group receiving 6 months BBCI. After the baseline measurement, prior to the intervention, all participants were followed up at 6, 12, and 18 months (Flow diagram figure 1). Because sustained behavioral change is defined as lasting for at least 12 months, all participants were followed up until 18 months after starting the intervention.

Interventions

Table 2 describes the contents of both SLI and BBCI. The BBCI consisted of individual counseling in 12 consultations, 45 minute each, during six months. Participants could chose to stop participating the BBCI and SLI earlier and withdrew from the study. The counseling was conducted at the GP practices and performed by 25 specifically trained students of Sports Health and Management of the Hanze University Groningen, the Netherlands. Both interventions were implemented by the same counselors, to ensure the therapist effect in both interventions was presumably the same.

The BBCI aimed at supporting participants in decreasing their existing BBs to PA in order to accomplish and pursue self-determined PA goals. Participants learn to cope with their BBs that may inhibit their regular PA. BBs were addressed using four different BB behavior change strategies: 1. develop means to reach the PA goal; 2. change PA goals to change goal related BBs; 3. restructure/change BBs, and 4. accept the investments and costs demanded by BBs (Table 1). The counseling technique was tailored to the participants' needs for developing an individual pattern of PA for the longer term. The BBCI focussed on setting mini-goals to change PA behavior, as this is expected to be more effective in long term health goals/outcomes[45,46]. Therefore, PA-standards[44] were released in the BBCI. For a complete description of the BBCI we refer to the barrier-belief approach in PA counseling that we published previously[33].

The SLI consisted of two 45-minute individual sessions, and regular 90-minute group meetings on five occasions for a maximum of six months. Sessions were performed in small groups (N=3 to 8). All sessions were conducted at the GP. The objective was to increase motivation for specific PA-goals and to pursue PA-standards[44]. Central to the SLI were the defined motivational stages of the TTM, that provided the content and tools for guidance to the next stage. During each session the intervention made a 1-phase-progress from the TTM, starting from pre-contemplation to action stages[47]. This intervention was not tailored to the participants' needs at different stages; at the group level all participants were treated as if they

were all in the same phase. In contrast to the BBCI, a directive approach was used in the SLI; when one's PA behavior deviated from the existing PA-standards, participants were encouraged to establish goals for maintaining PA at least 30 minutes/day[44] (Table 2).

Participants, randomization, and blinding

The study population was recruited through general practitioner (GP) practices from primary care centers in the north of the Netherlands. In total 13 GP practices participated. Participants were partly recruited directly by the GPs. Eligible participants were 18 to 70 years old, self-determined as 'inactive', willing to sign up for a PA intervention and , according to the GP, improving PA could reduce their complaints. Eligible participants could have been diagnosed with e.g. diabetes type 2, COPD, rheumatism, cancer, but were not confined to only stay at home. Excluded were individuals with a diagnosis of acute coronary heart disease, stroke, severe hypertension (systolic pressure >180 mmHg or diastolic pressure >120 mmHg), and participants diagnosed by the general practitioner with chronic depression or chronic pain were excluded. Also, highly active participants were excluded, i.e. when they reported being moderately active, >100 min/day. In the same period, patients from the same GPs received a letter inviting them to participate in the study. The letters were sent out to 5.000 randomly selected patients from the GP practices.

Eligible participants came in contact with the study after the GP invited them to join the study or in response to the invitation letter. After they were informed verbally and in written, participants gave written consent. Thereafter a counselor contacted them by phone and verbally checked inclusion and exclusion criteria for eligibility of all participants. Then the randomization was conducted. Baseline measures were done after randomization, just before start of the interventions. The intervention allocation was concealed until after the baseline examinations were completed.

A total of 245 enrolled participants were randomly allocated to the BBCI group (N=123) or the SLI group (N=122), using a computer-generated random numbers sequence. The allocation was concealed until *after* the baseline data collection, was completed, which took place prior to the start of the intervention. Baseline measurements were completed for 204 participants (83% of enrolled participants). Participants and counselors were not informed about the results of the measures.

Outcomes

All measurements in both groups were conducted at the GP practices by the counselors. At baseline, data on personal characteristics, PA, BBs and QOL were obtained. All participants had follow-ups at 6, 12 and 18 months. Four measurements per subject were conducted.

Primary outcomes in this study were the BBs related to PA. BBs were measured with a newly developed 62 item BB survey, based on social cognitive theory[35], empirical data and a qualitative study (chapter 3). For each item, the participants indicated on a 5-point Likert-scale to what extent they agreed that the presented BBs applied on them: "To what extent do you think that

the following factors hold you from engaging in PA?" ('strongly disagree' (1) – 'disagree' (2) – 'neutral' (3) – 'agree'(4) - 'strongly agree' (5)). Items related to the two main factors were grouped: negative self-efficacy expectations and negative outcome expectations. BBs were scaled by type to compose clusters of inhibiting beliefs, resulting in a classification of 10 different BB scales. The defined scales were: physical environmental factors, social factors, prioritizing, investment factors, skill factors, missing positive outcomes of the old behavior, negative feelings about the new behavior, negative outcomes of the new behavior, identity discrepancy, and disappointing results (Table 3). Internal consistency of the BB survey, analysed with Cronbach's Alpha (α), showed on all BB scales an $\alpha > .7$. Additionally, validity was tested on self-reports on intention, perceived pros and behavioral control and leisure time physical activity by a Pearson correlation and a multilevel regression analysis. Data provided a validation of all scales (chapter 3).

Table 3: Description of barrier beliefs

Barrier-beliefs scales	***Reflecting:***
	Self-efficacy related
Physical environmental factors	The inaccessibility of facilities, or counteracting conditions of the surrounding environment in performing PA
Social situations	A perceived deficiency in social support, or presence of social discouragement in performing PA
Prioritizing	The thought or verbalised experience that other behaviors are more important than PA in a specific moment and context
Investment factors	The costs of engaging in a difficult task, or coping with an aversive PA experience
Skill factors	The perceived disabilities to carry out PA-related tasks with pre-determined results of the PA behavior
	Negative outcome expectancy related
Missing the positive outcomes of the old behaviour	A loss of the functions of the old behavior that needs to be given up to become physically active
Negative feelings about the new behavior	Aversive emotions caused by performing PA
Negative outcomes of the new behavior	Negative experiences or results to the person following PA behaviour
Identity discrepancy	A contradiction between representations of the self in a context of performing PA causing an emotional vulnerability
Disappointing results	A non-correspondence between the experienced outcomes of PA with the expected outcomes of PA, yielding a deficient reward of effort

PA was measured with the Short Questionnaire to Assess Health-enhancing PA (SQUASH questionnaire)[48] and with an accelerometer (Actigraph GT3X)[49]. The SQUASH obtained participants' level of commuting, leisure-time and sports, household, and work-and-school activities[50]. With the accelerometer the PA measurement was obtained over a 7-day period, directly after baseline measurements and subsequently at each follow-up (at 6, 12, 18 months). This was the same period for each participant in the 18-month period. Accelerometers were placed on the right hip. Participants were instructed to wear the accelerometer for seven consecutive

days, and to only remove it while sleeping or in water-related activities (e.g. swimming or bathing). The Actigraph was set to record PA in a 60s epoch[51]. A valid day was defined as >10 hours of wear time. A minimum of four valid days was required to retain in the analysis[52]. Non-wear time was defined as 90 consecutive minutes of 0 cpm, allowing up to a 2-minute interval of counts between 0-200 cpm within 30 consecutive minutes of 0 cpm[53]. Intensity of PA was determined according to the VM3 cut-off points proposed by Freedson[54]: light intensity (LPA) (0-2689 cpm), moderate intensity (MPA) (2690-6166 cpm), vigorous intensity (VPA) (6167-9642 cpm) and very vigorous intensity (VVPA) (>9643 cpm). Moderate-to-vigorous intensity PA is a commonly used term for PA with an intensity >2690 cpm. Algorithms, using VM3 data, were available in the ActiLife software version 6.9.5.

Quality of life (QOL) was measured with items 29 and 30 of the EORTC QLQ-C30 (version 3.0,[55], the Linear Analog Self-Assessment (LASA overall and LASA physical)[56], Cantril's Ladder[57]. To compute the total QOL score, all scores were converted to a scale from 1 to 7 and then averaged[58]. Participants continued with their routine care, prescribed or advised by their general practitioner or specialist, throughout the study.

Statistical analysis

The effects of BBCI and SLI were analyzed on BBs, for which we used a multi-level regression analysis. Time and group interaction effects were assessed using mixed-model analysis. Group differences at each time point (start, 6, 12, 18 months) were assessed by pairwise comparison using general linear models with repeated measures. We conducted an all-cases analysis, including all participants with a baseline measurement. Additionally, because of the high dropout rate, we conducted an imputed intention-to-treat analysis. All missing data from baseline and follow-up measurements were imputed with predictive mean matching method[59]. Imputed data are show in the appendix.

Impact of the BBs on PA and QOL was assessed with multilevel regression analyses, relating outcomes on a change on BB scales and the change in PA and QOL, with accelerometer data (sedentary behavior, light PA and moderate to vigorous PA), self-reported PA (SQUASH-score), and total QOL score. For this analysis, both groups have been merged.

Gender, age, education, SQUASH score and BMI were included in the analysis as confounders, because data showed that these variables affected the dependent variable. A p-value < 0.05 was considered statistically significant. We calculated a statistical index of effect size (es) according to Cohen criteria[60]. The cut-off values used were: very small: < .2; small: .2 to .5; moderate: .5 to .8; large: > .8.

RESULTS

A total of 306 subjects gave written consent and 61 individuals were excluded at the eligibility measure of the counselor: 25 did not meet the inclusion criteria and/or presented with exclusion criteria, and 36 declined to participate. In total, 245 individuals were randomized to the BBCI (123) or the SLI (122). 10 BBCI and 31 SLI withdrew before baseline. 113 BBCI and 91 SLI were measured at baseline. After baseline, 16 BBCI and 14 SLI withdrew during intervention. Finally, 97 participants started in the BBCI and 77 in the SLI. The 18-month follow-up was completed by 63 BBCI and 60 SLI participants (40%). The outcomes and estimates of the study population are shown in Table 4 and Figure 1.

Outcomes and estimations

The mean age of the study population was 50 (SD 13) years, and 61% were female (Table 4). In this group 23% were overweight, defined as BMI >25, and 55% were identified as obese, defined as BMI >30. At baseline, 32% of the study population performed PA less than 30 minutes/day; 7% was sedentary or minimally active. All means and comparisons from baseline to 18 months are shown in Table 5 and Figures.

Table 4: Baseline characteristics of participants from the BBCI and SLI

	All participants N=204* (%)	Mean (SD)	BBCI N=113* (%)	SLI N=91* (%)
Gender				
Male	79 (39)		43 (39)	36 (40)
Female	121 (59)		67 (61)	54 (60)
Age		50 (12)	50 (12)	51 (12)
Marital status				
Married	104 (51)		56 (51)	48 (53)
Not married	33 (16)		20 (18)	13 (14)
Cohabiting	15 (7)		7 (6)	8 (9)
Other	19 (9)		14 (13)	5 (6)
Educational level				
Higher education	43 (22)		20 (18)	11 (12)
Secondary-vocational education	89 (44)		44 (40)	45 (50)
Lower education	53 (26)		33 (30)	19 (21)
Employment				
Yes	114 (56)		63 (57)	51 (57)
No	62 (30)		35 (32)	27 (30)
Presence of overweight or obesity				
Fraction with BMI < 25	36 (18)	22.7 (1.6)	15 (23)	9 (23)
Fraction with BMI ≥25 - < 30	47 (23)	32.5 (5.3)	29 (26)	25 (27)
Fraction with BMI ≥30	112 (55)	35.5 (4.3)	63 (57)	49 (54)
Exercise, min/day				
<30 min	93 (46)	17.6 (7.2)	46 (41)	47 (52)
30-60 min	52 (25)	42.5 (8.7)	28 (25)	24 (26)
>60 min	26 (13)	75.8 (15.5)	20 (18)	6 (7)

*) in case of less than n in frequencies, cases were missing.

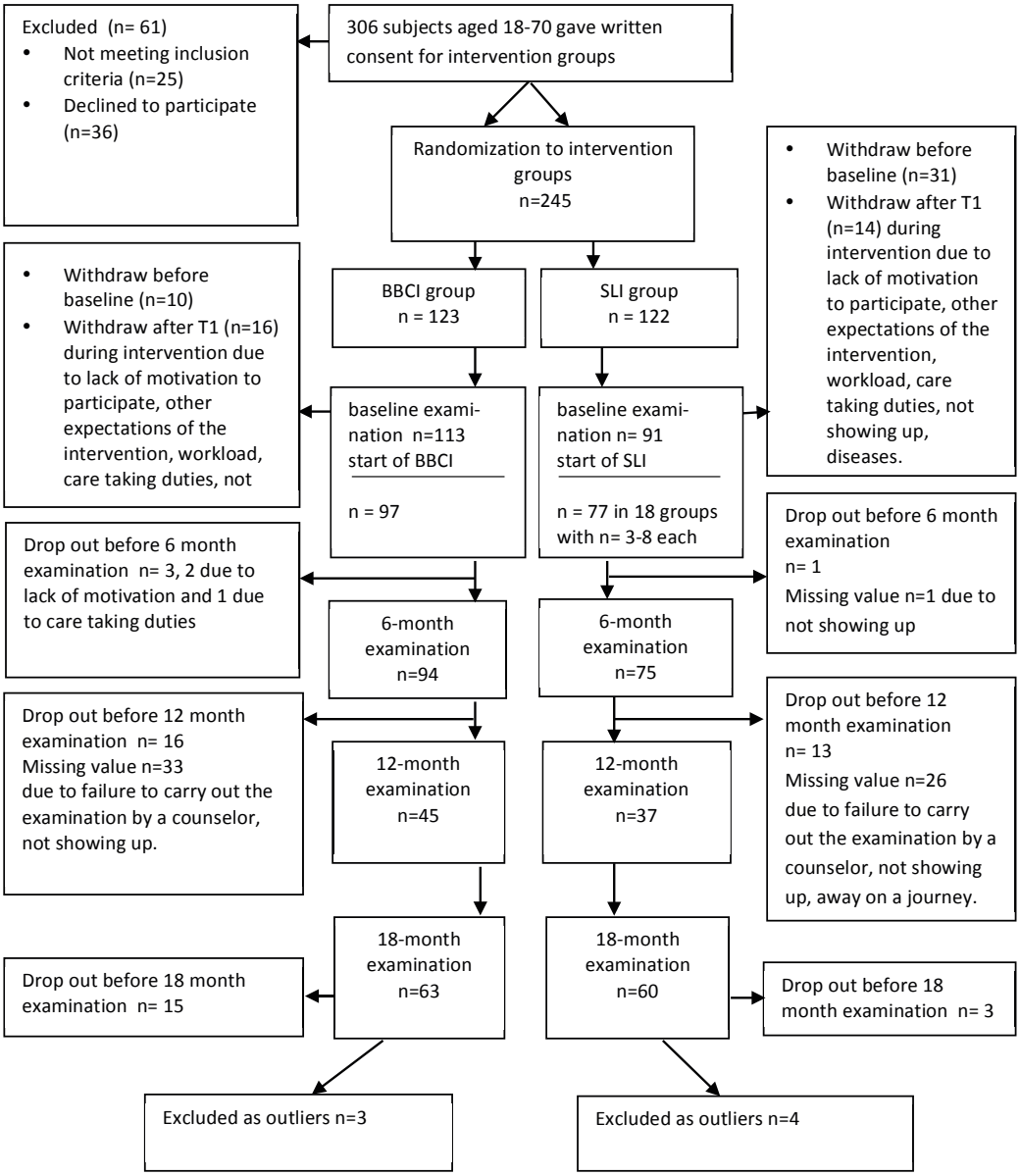


Figure 1. Participant' s flow diagram

Table 5: P-values of the fixed effects of factors included in the analysis as confounders.

Fixed effects (P value)	Confounders				
Dependent variable	**Gender**	**Age**	**BMI**	**Education**	**SQUASH score**
Physical environmental factors	.44	.51	.88	.04*	.02*
Social factors	.99	.31	.26	.07	.43
Prioritiziing	.31	.08	.30	.16	.31
Investment factors	.94	.38	.64	.08	<.01*
Skill factors	.80	.48	.14	.17	.56
Missing the positive outcomes of the new behavior	.10	.02*	.65	.03*	.13
Negative feelings about the new behavior	.98	.49	.15	.29	.03*
Negative outcomes of the new behavior	.32	.50	.50	<.01*	.63
Identity discrepency	.57	.47	.26	.23	.59
Dissapointing results	.89	.77	.09	.06	.12

*) significant effect of the factor on the depend variable

Confounders

Gender, age, BMI, education and total activity score were included in the analysis as confounders. The fixed effects of gender, age, BMI, educational level, and total activity score on the dependent variables are shown in Table 5.

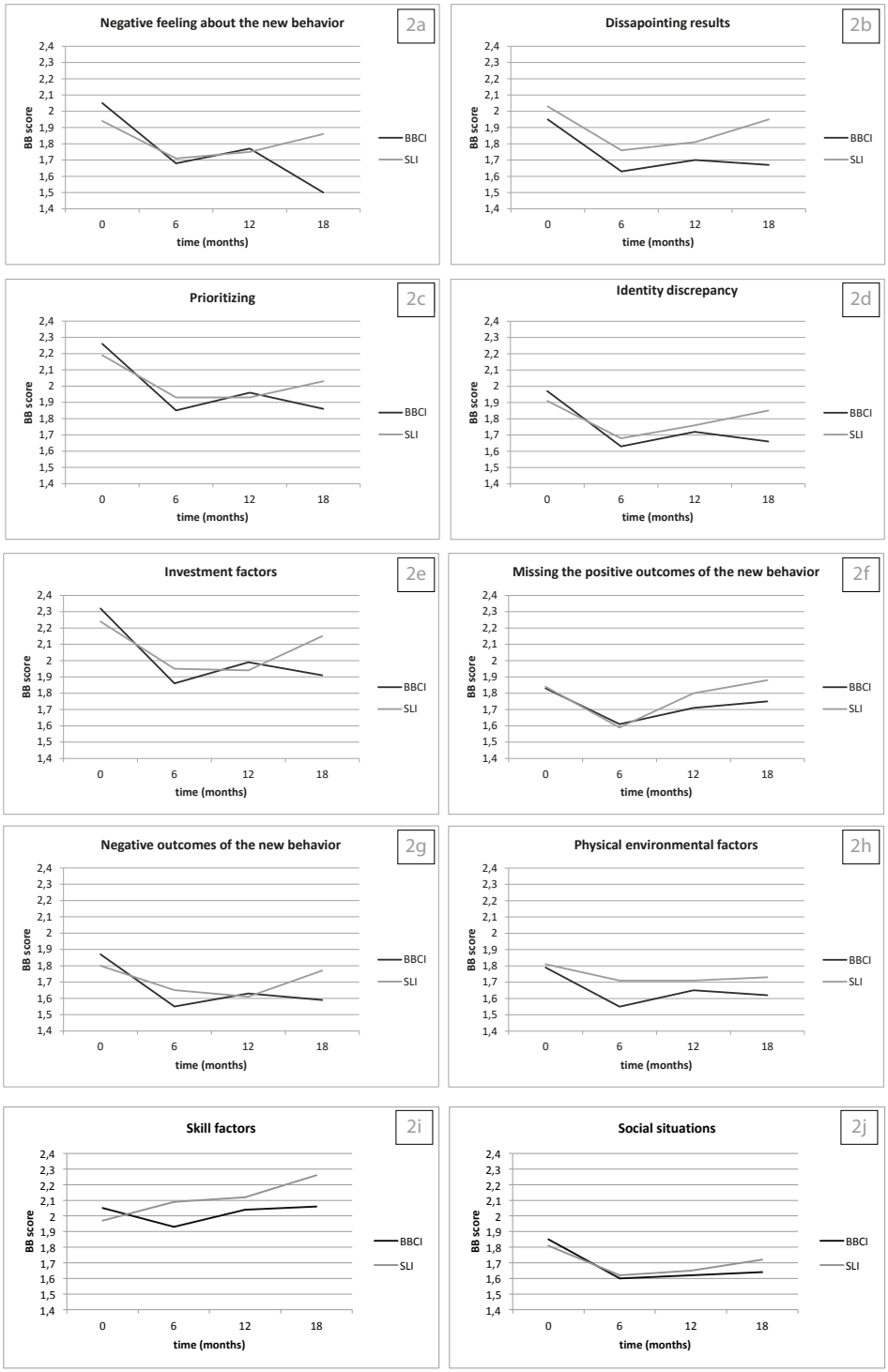
Barrier beliefs

Baseline scores did not differ significantly between both intervention groups (Figures & Table 6). In both intervention groups, BB scales decreased significantly during the 6 month intervention and additional 12 months follow up. But in the BBCI group scores decreased more over time. Compared to baseline, in the BBCI group a significant decreased in eight out of ten BB scales was shown at 6, 12 and 18 months follow-up ($p< .01$ & $p< .05$), although effect size calculations showed small-to-very small effects. In the SLI group the BB scales decreased significantly compared to baseline, mainly at 6 and 12 months ($p< .01$ & $p< .05$) with small-to-very small effect sizes. At the 18 months follow-up, in the SLI, none of the BB scales decreased significantly as compared to the findings at baseline. In the BBCI group, in 9 of the BB scales, except 'physical environmental factors', a main time effect was found ($p<.01$). In seven out of ten BB scales a significant interaction effect between time and group ($p<.05$) on PA was found.

Table 6: All-cases analysis of means and comparisons from baseline to 18 months in the randomized controlled trial: differences between interventions groups BBCI and SLI.

		BBCI				SLI							
	Follow-up	n	Mean sign	St dev	Effect Size	n	Mean	St dev	Effect Size	BBCI-SLI	Time	Group	Time* Group inter-action
Negative feelings about the new behavior	0	101	2.05	.76		83	1.94	.68		.25	.00	.41	.04
	6	88	1.68**	.62	.26	65	1.71 **	.61	.18	.90			
	12	55	1.77**	.68	.19	34	1.75*	.62	.14	.37			
	18	53	1.75**	.65	.21	44	1.86	.61	.06	.63			
Disappointing results	0	101	1.95	.74		83	2.03	.78		.54	.00	.25	.03
	6	88	1.63**	.66	.22	65	1.76**	.73	.18	.27			
	12	55	1.70**	.72	.17	34	1.81*	.78	.14	.29			
	18	53	1.67**	.65	.20	44	1.95	.74	.05	.08			
Prioritizing	0	101	2.26	.77		83	2.19	.81		.50	.00	.79	.02
	6	88	1.85**	.74	.26	65	1.93**	.72	.17	.59			
	12	55	1.96**	.73	.20	34	1.93*	.78	.16	.35			
	18	53	1.86**	.74	.26	44	2.03	.77	.10	.39			
Identity discrepancy	0	101	1.97	.73		83	1.91	.71		.52	.00	.22	.00
	6	88	1.63**	.67	.24	65	1.68**	.62	.17	.54			
	12	55	1.72**	.72	.17	34	1.76	.61	.13	.63			
	18	53	1.66**	.63	.22	44	1.85	.62	.04	.15			
Investment factors	0	101	2.32	.68		83	2.24**	.75		.35	.00	.84	.00
	6	88	1.86**	.61	.34	65	1.95**	.67	.20	.34			
	12	55	1.99**	.71	.23	34	1.94	.71	.20	.56			
	18	53	1.91**	.65	.30	44	2.15	.67	.06	.21			
Missing the positive outcomes	0	101	1.83	.77		83	1.84	.76		.72	.00	.19	.11
	6	88	1.61**	.63	.15	65	1.59**	.50	.19	.74			
	12	55	1.71	.81	.08	34	1.80	.64	.03	.33			
	18	53	1.75	.72	.05	44	1.88	.67	-.03	.23			
Negative outcomes of the new behavior	0	101	1.87	.73		83	1.80	.68		.74	.02	.09	.01
	6	88	1.55**	.62	.23	65	1.65*	.59	.12	.31			
	12	55	1.63*	.71	.16	34	1.61*	.69	.14	.93			
	18	53	1.59**	.67	.20	44	1.77	.70	.02	.26			
Physical environ-mental factors	0	101	1.79	.66		82	1.81	.59		.41	.06	.39	.40
	6	88	1.55*	.55	.19	65	1.71*	.67	.08	.42			
	12	55	1.65	.64	.12	34	1.71*	.65	.08	.72			
	18	53	1.62	.58	.14	44	1.73	.60	.07	.24			
Skill factors	0	99	2.05	.63		81	1.97	.67		.29	.00	.06	.01
	6	88	1.93**	.76	.09	65	2.09**	.80	-.08	.52			
	12	55	2.04**	.79	.01	34	2.12**	.89	-.09	.54			
	18	53	2.06**	.83	-.01	44	2.26**	.75	-.20	.20			
Social factors	0	101	1.85	.74		83	1.81	.67		.86	.00	.84	.57
	6	88	1.60**	.63	.18	65	1.62**	.58	.15	.83			
	12	55	1.62*	.69	.16	34	1.65*	.65	.12	.87			
	18	53	1.64*	.66	.15	44	1.72	.64	.07	.58			

*) within-group significant difference compared to baseline measurement ≤ .05; **) within-group significant difference compared to baseline measurement ≤ .01; Effect size relative to baseline, according to Cohen's criteria: very small, < .2; small, .2 to .5; moderate .5 to .8; large, > .8. Data are given as estimated margin means derived from mixed-model analysis. P-values for group differences at each time point were assessed by pairwise comparison using general linear models with repeated measures. P-values for effects between time+group interaction effect were assessed using mixed-model analysis.



Figures 2a-j: Effects of the BBCI and SLI on the outcomes of different types of barrier beliefs at 6,12 and 18 month follow-ups

Impact of changing BBs on PA and QOL

Multilevel regression analyses were conducted on BB scales related outcomes on a change on BB scales and the change in PA (SQUASH-score and outcome of the accelerometer: sedentary behavior, light PA and moderate to vigorous PA) and QOL score (Table 7). Results show that an increase in SQUASH-score was significantly explained by a decrease in 8 out of 10 BB scales (β = -.26 to -.13; $p < .05$; R^2 = -.04 to .08). Only a decrease on the BB scale *'social factors'* explained significantly ($p <$ .05) a decrease on sedentary behavior (β = .14; R^2 = -.07). A change on light PA was not explained by a change in BBs. A decrease in the BB scale '*physical environmental factors*' explained significantly ($p <$ .05) a change on moderate-to-vigorous PA. An increase in QOL was significantly explained ($p <$ .05) by a decrease on BBs in 6 out of 10 BBs (β = -.27 to -.08; $p < .05$; R^2 = -.01 to .02).

In the end-model of a multilevel analyses of *clusters* of barrier-belief scales, an improvement in the SQUASH-score was significantly explained (R^2 = .10) by a decrease in three BB scales: '*identity discrepancy*' (β = .18; $p < .05$), '*physical environmental factors*' (β = -.17; $p < .05$) and '*investment factors*' (β = -.28; $p < .01$). An improvement of QOL was explained in the end model (R^2 = .10) by a decrease in three BB scales: *'missing the positive outcomes of the new behavior'* (β = .23; $p < .01$), *'negative feelings about the new behavior'* (β = -.25; $p < .01$) and '*investment factors*' (β = -.18; $p < .05$) (Table 7).

Table 7: Fixed effects of Δ barrier-belief scales on a change in physical activity scores and quality of life.

Depend variables:	**Δ SQUASH score**		**Δ Sedentairy behavior**		**Δ Light PA**		**Δ Moderate to vigorous PA**		**Δ Quality of Life**	
Multilevel regression analysis	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2
Barrier-belief scales										
Δ Physical environmental factors	-.19**	.03	ns	ns	ns	ns	-.10*	.10	ns	ns
Δ Social situations	-.10*	-.04	.14*	-.07	ns	ns	ns	ns	ns	ns
Δ Prioritizing	-.12*	.07	ns	ns	ns	ns	ns	ns	-.10*	-.01
Δ Investment factors	-.26**	.08	ns	ns	ns	ns	ns	ns	-.21**	.01
Δ Skill factors	ns	ns	ns	ns	ns	ns	ns	ns	-.27**	.02
Δ Missing the positive outcomes of the old behavior	-.13*	.02	ns	ns	ns	ns	ns	ns	ns	ns
Δ Negative feelings about the new behavior	-.20**	.03	ns	ns	ns	ns	ns	ns	-.24**	.01
Δ Negative outcomes of the new behavior	-.13*	.01	ns	ns	ns	ns	ns	ns	ns	ns
Δ Identity discrepancy	ns	ns	ns	ns	ns	ns	ns	ns	-.14*	.01
Δ Disappointing results	-.13*	.01	ns	ns	ns	ns	ns	ns	-.08*	.01
Clusters of barrier-belief scales										
Δ Identity discrepancy Δ Physical environmental factors Δ Investment factors	.18* -.17* -.28**	.10								
Δ Missing the positive outcomes of the old behavior Δ Negative feelings about the new behavior Δ Investment factors									.23** -.25** -.18*	.10

* $p < .05$, ** $p < .01$, *ns= non-significant effect*, Δ='" a change on.."

DISCUSSION

The BBCI is more effective in changing BBs, in the short and long term, than SLI. The effects showed a stronger decrease of specific BBs and a related increase of PA and QOL, irrespective of the intervention causing the BB changes to occur. These findings enhanced our understanding of barriers about PA and suggested that incorporating BBs in counseling might be useful for increasing PA and QOL.

All 10 types of BBs related to PA were reduced by the BBCI in the long term. At baseline, participants most frequently expressed BBs to PA on 'prioritizing' and 'investment factors'. Additionally, the BBCI was most effective in 'investment factors' and 'prioritizing' scales. In the way we implemented the BBCI, the largest changes were measured in these two types of BBs. In addition, it appeared that 'investment factors', 'physical environmental factors' and 'identity discrepancy' had the most influence on PA (SQUASH-score). 'Skill factors', 'negative feelings about the new behavior' and 'missing positive outcomes of the old behavior' had the most impact on QOL. Those BB types seems to be important. Thus, to integrate PA activities into daily life, adapted to someone's skills, environment-, and investment opportunities, may increase the chance that the PA behavior is sustained when motivation decreases. Additionally, a decrease in BBs on skill factors, negative feelings about the new behavior and missing the positive outcomes of the old behavior may increase QOL on the long term.

The difference in effects on BBs between the BBCI and the SLI was small. Although 7 out of 10 BB scales had significant interaction effects on time*group, data did not show significant group effects. As described in the introduction, effects of SLI on BBs in the short term were to be expected[20-24,61,62]. Our result showed, however, that adding a BB strategy can further improve PA in lifestyle interventions in the long term and possibly prevent relapse. Outcomes from our earlier study[43] (RCT in 204 'inactive' primary care patients, aged 18-70) already showed that the BBCI was more effective in changing PA compared to the SLI ($p < .01$): Due to the BBCI, on the short term, all PA outcomes improved significantly. In the long term, moderate to vigorous PA outcomes improved significantly. In this study we showed that a decrease in BBs has had its impact

To formulate PA goals, people must have at least some motivation to engage in PA. That is, people set goals based on their motivation to achieve certain valued outcomes, such as looking good, losing weight, or lowering their risk for heart disease. Importantly, in the BB approach, the client's motivation to engage in PA is not boosted to set high goals. Instead, the client's spontaneous intrinsic motivation is explored and only when clients miss knowledge on the basic positive effects of PA they are provided with potentially motivating information. In our opinion, lasting motivation can develop when it is based on one's own (positive) experience with PA. Thus, in participants with a motivational conflict to goal accomplishment, enabling at least some motivation to engage in PA will be essential. Therefore, a requirement for an intervention addressing goal related barrier beliefs, and before applying change strategies, is the presence of a minimal level of motivation.

It appears that both interventions were unable to effectively target BBs on "skill factors" to perform PA behavior, consisting of single BBs, such as "I have no perseverance" or "I can't maintain the exercise". Decreasing BBs on skill factors may demand additional change techniques for specific behaviors. Offering behavioral change techniques in counseling to handle the perceived disabilities to carry out PA related tasks, as in 'exposure' coached by a health professional, will help participants more effectively to overcome BBs on their skills[63,64].

The multilevel regression analyses showed that a decrease in specific BB scales was significantly related to higher levels of PA and QOL. BBs only explained the *self-reported* PA (SQUASH activity scores) and QOL. Only a limited number of BB scales were related to the objectively measured PA outcomes; participants underestimated their PA. It is plausible that BBs explain better a self-report of PA level because they are both *subjective* outcomes. We found that the perceived PA level did not corresponded with the objectively performed PA, which is in line with a recent study in 320 office-workers[65]. Possibly, the self-reported PA measure assessed satisfaction with the own level of PA. Then, a relation between one's perceived PA level and his/her perceived barriers is likely, for BBs indicate a discrepancy between how active a person *is* and how active he or she *wants* to be. In future research, we recommend, therefore, to use objective PA measurements to better measure the actual effect.

We expected BBs to arise when people started to become more active, in particular BBs such as "missing the positive outcomes of the new behavior" or "negative feelings about the new behavior". On a group level, our data show that this was not the case. An explanation could be that only at the start and at the end of the intervention BBs were measured. It is to be expected that BB will occur somewhere during the intervention, but will also have passed the measurement at 6 months. Yet, in our population, BBs were not created by becoming more active, after 6 months. Additional analyses on all follow-up moments corroborated this in a subgroup of participants. At each follow-up time point, a negligible number of participants did not experience a specific type of BB.

This study has a number of limitations. First, we must be cautious about the effectiveness of this particular concept of inhibiting BBs, for various reasons. A "package strategy" was conducted in both interventions. Both interventions included various behavioral change techniques, which makes it complex to pinpoint the exact mechanism of the interventions. Such issues may be systematically explored in modeling experiments where elements of an intervention are manipulated. Second, the deficit of data at the 12-month follow-up might have given a distortion of the trend. However, results of analyses with the imputation of missing values showed that we might conclude that missing data did not have a significant effect on the outcomes (Table Appendix). Third, a substantial group of participants in both interventions turned out to be fairly active at the start of the intervention. A reason may be that not an objective PA measurement was not used as cut-off point for eligibility-screening. Additionally, patients recruited by the general practitioner. Previous research has shown that unmotivated people are referred less often by GPs[67]. People who are motivated to PA and may have started PA before baseline. The same could have applied to people who volunteered to join the study.

Finally, gender, age, BMI, educational level, and total activity scores were included in the analysis as confounders. These factors may have had their influence on the outcomes. The next step would be to investigate further important BBs to PA in different populations.

In conclusion, this study adopted a social cognitive perspective to improve our understanding of barriers associated with PA maintenance. Inactive patients in primary care carry numerous BBs to PA participation, and change strategies, such as a BBCI, may be useful in primary care interventions to target this population. The BBCI was more effective in decreasing BBs compared to the SLI in the long term. Although we have to be careful in generalizing trial findings to the general population, lowering specific types of BBs, appear to contribute to increased PA behavior and improved QOL in the long term. Therefore, BB change strategies could be useful in, or added to PA counseling, for those experiencing or expressing BBs. For individuals with a motivational conflict, intervening on motivation will be essential. The efficacy of various elements of the BBCI on behavior requires further exploration to maximize impact and to refine strategies.

Declarations: ETHICS: Ethical approval was necessary to conduct this research. Subjects gave written informed consent. FUNDING: The study was funded by departmental resources. DISCLOSURE: All authors ensure their independence in designing the study, interpreting the data, writing, and publishing the report. The authors declare that there is no conflict of interest.

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Table Appendix: Intention-to-treat analysis of means and comparisons from baseline to 18 months in the randomized controlled trial: differences between imputed data of intervention groups BBCI and SLI.

		BBCI				SLI			
	Follow-up	n	Mean sign	SD	E.S	n	Mean sign	SD	E.S
Negative feelings about the new behavior	0	110	2.06▪	.76		90	1.94	.69	
	6	110	1.73*	.63	.23	90	1.72*	.63	.16
	12	110	1.79*	.69	.18	90	1.72*	.64	.16
	18	110	1.77*	.64	.20	90	1.8	.63	.11
Disappointing results	0	110	1.97	.75		90	2.05▪	.78	
	6	110	1.67*	.70	.20	90	1.82*	.79	.14
	12	110	2.00	.85	-.02	90	2.11	.90	-.04
	18	110	1.70*	.74	.18	90	1.85	.80	.13
Prioritizing	0	105	2.27	.77		85	2.19	.81	
	6	105	1.89*	.75	.24	85	1.94	.74	.16
	12	105	1.91*	.76	.23	85	1.83*	.76	.22
	18	105	1.93*	.77	.22	85	2.01	.79	.11
Identity discrepancy	0	110	1.97▪	.73		90	1.91▪	.72	
	6	110	1.65*	.68	.22	90	1.69*	.63	.16
	12	110	1.73*	.70	.17	90	1.75	.65	.12
	18	110	1.74*	.65	.16	90	1.83	.62	.06
Investment factors	0	110	2.31	.68		90	2.23	.75	
	6	110	1.89*	.62	.31	90	1.98*	.69	.17
	12	110	2.04*	.72	.19	90	2.03*	.73	.13
	18	110	1.98*	.68	.24	90	2.07	.70	.11
Missing the positive outcomes	0	105	1.83	.77		85	1.87▪	.76	
	6	105	1.61*	.62	.16	85	1.61*	.53	.19
	12	105	1.73	.76	.07	85	1.78	.68	.06
	18	105	1.79	.73	.03	85	1.88	.68	-.01
Negative outcomes of the new behavior	0	105	1.87▪	.73		85	1.82▪	.68	
	6	105	1.56*	.62	.22	85	1.63*	.61	.15
	12	105	1.64*	.72	.16	85	1.65*	.72	.12
	18	105	1.64*	.70	.16	85	1.73	.72	.06
Physical environmental factors	0	105	1.65	.66		85	1.70	.59	
	6	105	1.44*	.54	.17	85	1.53*	.65	.14
	12	105	1.53	.64	.09	85	1.56*	.66	.11
	18	105	1.51*	.59	.11	85	1.59	.59	.09
Skill factors	0	110	2.04▪	.64		90	1.97▪	.68	
	6	110	1.96*	.80	.06	90	2.06*	.85	-.06
	12	110	2.11*	.88	-.05	90	2.08*	.93	-.07
	18	110	1.98*	.89	.04	90	2.08*	.86	-.07
Social situations	0	105	1.86	.73		85	1.82	.67	
	6	105	1.60*	.62	.19	85	1.61*	.59	.16
	12	105	1.63*	.67	.16	85	1.64*	.66	.13
	18	105	1.68*	.67	.13	85	1.72	.66	.07

* within-group significant difference with baseline ≤ .01; ▲significant difference with SLI at same follow-up moment ≤ .05; ▪ significant difference with control group at same follow-up moment ≤ .05. Effect size relative to baseline, according to Cohen's criteria (Cohen, 1988): very small, < .2; small, .2 to .5; moderate .5 to .8; large, > .8.

6

CHAPTER 7

A CROSS SECTIONAL ANALYSIS OF MOTIVATION AND DECISION-MAKING IN REFERRALS TO LIFESTYLE INTERVENTIONS BY PRIMARY CARE GENERAL PRACTITIONERS; A CALL FOR GUIDANCE

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ABSTRACT

Aim: To explore GPs′ motivation to refer to lifestyle interventions and to investigate the association between GPs' own lifestyle-behaviors and their referral behavior, and patient indicators in the decision-making process of the GPs' referral to lifestyle interventions.
Method: A cross-sectional study was conducted among 99 Dutch primary care GPs. Their motivation to refer was assessed by beliefs regarding lifestyle interventions. GPs' referral behaviors were assessed, considering referral and self-reported actual referral, and their own lifestyle behaviors (physical activity, dieting, being overweight). Decision-making regarding referring patients to lifestyle interventions was assessed by imposed patient indicators, spontaneously suggested decisive patient indicators, and by case-based referring (vignettes).
Results: A substantial group of GPs was not motivated for referral to lifestyle interventions. GPs' refer behavior was significantly associated with their perceived subjective norm, behavioral control, and their own physical activity and diet. Most important patient indicators in referral to lifestyle interventions were somatic states, and patients' motivation for lifestyle interventions.
Conclusion: GPs motivation and referral behavior might be improved by providing them with tailored resources about evidence based lifestyle interventions, with support from allied health professionals, and with official guidelines for a more objective and systematic screening of patients.

INTRODUCTION

The prevalence of lifestyle-related chronic diseases is increasing worldwide. Lifestyle-related risk factors such as lack of physical activity, smoking, over-nutrition and alcohol consumption, are causes of the majority of chronic diseases[1], including diabetes, cardiovascular disease, obesity and several malignancies[2] According to the World Health Organization, the primary healthcare setting can contribute substantial to counter this global epidemic[3]. Lifestyle interventions at General Practitioner (GP) practices have shown moderate but significant effects.[4,5] These programs focus on an improvement of physical activity or diet, through consultations with a coach. Importantly, GPs agree that they have a legitimate role to play in referral to lifestyle interventions[6] – and yet the sobering reality is that GP referrals to lifestyle interventions are not a broadly applied practice so far[7].

GPs may have legitimate reasons not to embrace referral to lifestyle interventions: Besides concerns about the effectiveness of such interventions and program deficiencies, GPs indicated lack of time, lack of confidence in providing advice, low estimated effectiveness of these interventions, lack of skills, and insufficient knowledge as immediate and significant barriers to this referral process[8,9]. Rubio-Valera[10] stated that the main factors affecting the implementation of lifestyle interventions are beliefs, attitudes and motivations of professionals, which should be changed for a better implementation. Geense[11] conducted a qualitative study and identified 41 barriers mentioned by GPs. In conclusion, there still is little empirical evidence on factors that influence GPs' referral behavior to lifestyle interventions. The present study explores GPs' motivation and decision-making to refer patients for lifestyle programs.

GPs' motivation to refer to lifestyle interventions

Firstly, to map causes of the referral behavior of GPs, we applied the theory of planned behavior (TPB)[12]. This model predicts the occurrence of specific behaviors, provided that they are intentional. The TPB is the most frequently operationalised social cognitive perspective on behavior, which makes the data from the present study comparable with many other studies on different and similar behaviors. The TPB suggests that three variables will predict the intention (or motivation) to perform a behavior. In the present context, the motivation to refer is based on: *attitudes,* reflecting the degree to which the GP has a favourable or unfavourable evaluation of lifestyle interventions; *social norms*, reflecting the GP's perceived social pressures to perform or not perform referral behaviors, and; *perceived behavioral control*, revealing the GP's perceived ease or difficulty in performing referral behaviors. Besides professional estimates also personal experiences with a healthy lifestyle may influence GPs referral behavior.

The GP behavior under study is conceptualised here as 'referral behavior', consisting of two distinct actions: *Considering referral*, i.e. making an estimation of whether a follow-up service is desired given the unique situation of the individual patient, and *actual referral,* i.e. asking the patient if he/she wants to be referred to a specific intervention and taking care of the referral (Figure 1).

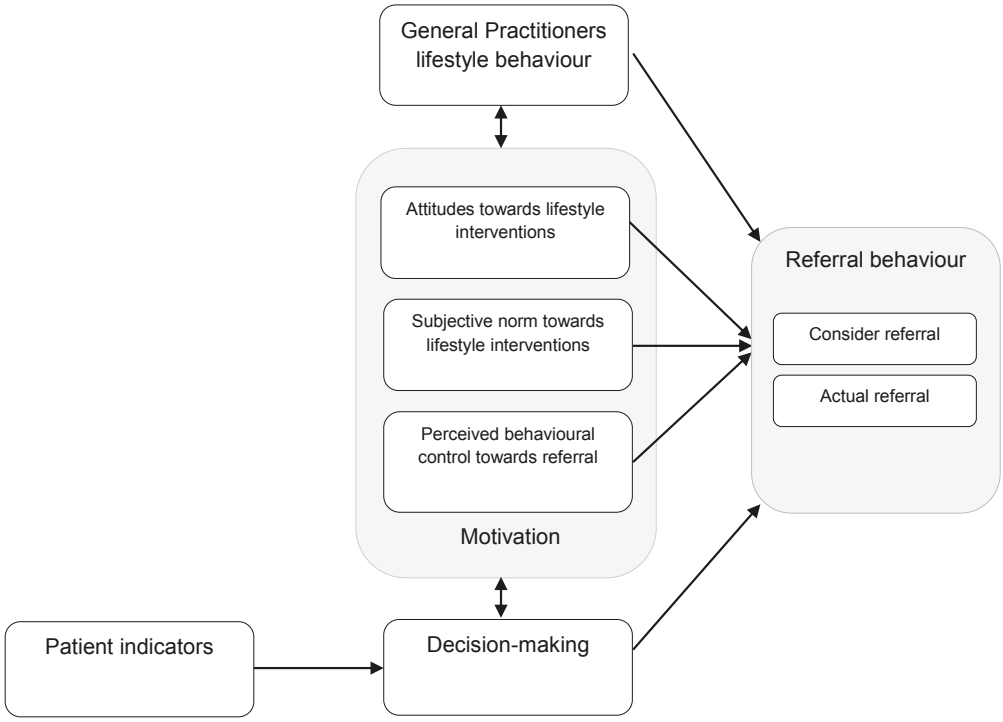

Figure 1: Factors influencing referral to lifestyle interventions based on the Theory of Planned Behavior (Ajzen, 1991)

Two other studies about referral behavior to lifestyle interventions among GPs, using the TPB, showed that GPs' *implementation* of lifestyle interventions was indeed influenced by their attitudes, social norms and control beliefs[13,14]. However, no statement was made about GPs' *motivation to refer* to lifestyle interventions, and both GP samples were small. In addition, the present study went one step further by also investigating whether there is an association between GPs' own lifestyle and their referral behavior towards lifestyle interventions. We found little research on this topic, although one study proved that GPs' experiences with managing their own weight influenced their approach to referral[14]. Additionally, Baarveld's study[15] provided data on the association between GPs' interest in sports and their sports prevention-oriented services.

Patient indicators in referring patients to lifestyle interventions

To map causes of the referral behavior of GPs we also assessed their professional decision-making, in which they (should) make use of patient indicators to decide about the appropriateness and effectiveness of a lifestyle intervention (Figure 1). Although there is a need for more support in referring to lifestyle treatments in GPs practice[16], no formal guidelines have yet been defined[17].

Little is known about patient indicators in referring patients to lifestyle interventions. Britt et al[18] concluded that decisions on lifestyle referral leave room for individual GP judgements, which makes the decision-making process largely dependent on GP preferences and expertise of lifestyle. So, there is a need to obtain insight into GPs' decision-making process of GPs for a better referral.

Aim

The first aim of this study was to explore GPs´ motivation to refer to lifestyle interventions and to determine whether there is an association between GPs own lifestyle-behavior and their referral behavior. The second aim was to explore patient indicators used by GPs in the decision-making process of referral to lifestyle interventions. To this end we conducted a cross-sectional study among GPs using a survey.

METHOD

Recruitment

Dutch GPs were recruited by letter from May–October 2012. The Dutch Institute for Health Services Research (NIVEL) provided mail addresses of 800 randomly selected GPs and sample data on gender, age, type of practice (solo, duo, health centre), employment status (practice owner, locum GP, in employment) and years of practice. Letters were sent out to all 800 GPs. A reminder was sent after a month. In the same period, regional GPs were recruited via advertisements in a newsletter from University Medical Center Groningen ("Verwijzerscontact" – Wenckebach Institute). In both the letter and the advertisement, GPs were invited to join the study on GPs' beliefs regarding lifestyle interventions and their referral behavior to lifestyle interventions.

Procedure

GPs were asked to complete a single digital survey on a website which informed them about the purpose and procedure of the study before they filled out the survey. It was also communicated that anonymity and confidentiality were guaranteed. Finishing and sending the survey electronically was considered as consent to use the respondents' data in this study. The survey took about 20 minutes to complete.

Measurements

GPs' personal characteristics were classified according to the NIVEL-provided data mentioned above (see *Recruitment*). They were asked to indicate on a 5-point Likert scale to what extent they agreed on 19 lifestyle intervention-related beliefs (*strongly disagree (1) – disagree (2) – neutral (3) – agree (4) - strongly agree (5)*). Beliefs were operationalised using the validated TPB application to health professional behavior[19], and the experience of the research team using the

TPB in questionnaire development. This part of the questionnaire contained beliefs towards lifestyle interventions; social support when referring to lifestyle interventions, and GPs' self-efficacy expectations in referring to lifestyle interventions. Referral behavior was assessed with two questions: 'In all the patients I see, I consider (briefly) whether they are eligible for a lifestyle intervention' (considering referral), and 'In the past year I have regularly referred patients to a lifestyle intervention' (actual referral). Furthermore, GPs were asked whether they had the possibility to refer a patient to lifestyle intervention (*yes/no*) in the vicinity.

GPs' own lifestyle was, firstly, measured by a self-report on their physical activity level (*very active (1) –active (2) –fairly active (3) –inactive (4) –very inactive (5)*), time spent on physical activity *(<1 hours/w (1) – 1-2 hours/w (2) – 2,5-5 hours/w (3) – >5 hours/w (4)*), and the personal importance of physical activity (*very important (1) – important (2) – fairly important (3) – unimportant (4) - very unimportant (5)*). Secondly, GPs' own lifestyle was measured by a self-report on how healthy their diet was (*very healthy (1) – healthy (2) – fairly healthy (3) – unhealthy (4) - very unhealthy (5)*), the importance of a healthy diet (*very important (1) – important (2) – fairly important (3) – unimportant (4) - very unimportant* (5)), BMI, height, weight, and their opinion about their weight (*underweight (1) – healthy weight (2) – overweight (3) - seriously overweight (4) – don't know (5)).* Lastly, GPs were asked whether they smoked daily (*yes/no*).

To increase insight into the professional decision-making concerning lifestyle interventions, three different assessments were done. Firstly, GPs were presented with nine patient indicators to indicate whether these were important to them in referring to lifestyle interventions, and which quality of the indicator was most eligible for a lifestyle intervention. The nine assessed potential patient indicators were gender, language, ethnicity, age, educational level, motivation, medical suitability, physical activity behavior and diet.

The second method to explore decision-making used eight patient cases (described by 57 words each) that differed on age, educational level and presence of complaints, in the various combinations (2x2x2=8): In four cases a patient from a lower age group (age <55) was presented, in four cases a higher age group (age >70); in four cases the level of education was low, in four cases high; in four cases the patient had complaints, in four cases none. In all presented cases the patients were inactive, defined as <30 minutes of moderate physical activity each day. Also in all cases BMI was normal because earlier research already revealed that BMI was used by GPs for treatment decisions[20]. Below a case example:

A patient comes to your practice. The patient is 39 years old, highly educated and has a healthy weight (BMI <25). He has an inactive lifestyle, defined as <30 minutes of moderate physical activity each day. The patient has a demand for care in which a medical intervention or specialist referral is not immediately indicated. There is a possible relation between the patients' complaints and his/her inactive lifestyle; you do not preclude this connection.

For each case, GPs were asked: a) to what extent they considered referring this patient to a lifestyle intervention; b) if they found the patient eligible for a lifestyle intervention; c) if they

actually would refer the patient to a lifestyle intervention. All three questions could be answered on a 5-point Likert-scale *(very certainly not (1) – certainly not (2) – neutral (3) – certainly do (4) – very certainly do (5)*). To analyse these data, three dichotomous variables were coded: age (high/low), education (high/low), complaints (yes/no). Using within-subject analysis of variance (repeated measures; $p < .05$), the differences were analysed between the two levels of the three indicators for each of the three above-mentioned measures of referral.

The third method to explore the decision-making process was comprised of two open questions on indicators to refer and *not* to refer: 'What is an indication for you to refer a patient to a lifestyle intervention?' and 'When would you *not* refer a patient to a lifestyle intervention?'.

RESULTS

Characteristics of GPs

A total of 134 GPs started to fill out the survey. Records of 28 GPs were omitted from analyses because they only logged on to the survey without filling out answers, and 7 GPs only filled out the personal characteristics section. This resulted in a sample of 99 GPs (Table 1).

Table 1: Sociodemographics of participating GPs compared to sample data

	Participating GPs (N=99)		A-selected sample (N=800)	
	%	mean /median	%	mean /median
Gender (%) - male - female	 39 61		 56 44	
Age (years)		50/52		49/50
Type of practice - solo practice - duo practice - health centre - missing	 22 22 33 23		 25 39 36	
Working status (%) - practice owner - locum GP - in employment	 35 2 65		 87 - 13	
Years of practice		20/21		20/20

GPs' motivation to refer to lifestyle interventions

GPs' beliefs regarding lifestyle interventions were explored, firstly, by computing the percentages of GPs who endorsed beliefs regarding lifestyle interventions and the relation between lifestyle intervention-related beliefs and GPs' referral behaviors. Secondly, to determine the relative strength of GP's beliefs as predictors of referral, multiple linear regression analyses were conducted (using the Entry and the Stepwise methods) regressing the intervention-related beliefs on 'considering referral' and 'actual referral'. Furthermore, the relation between GPs' own lifestyle and referral behaviors was computed.

Belief endorsement: The endorsement of beliefs about lifestyle interventions and referrals varied among GPs (Table 2). While about 60% to 80% of GPs were positive about lifestyle interventions, 20% to 40% of GPs were neutral or negative about lifestyle interventions. Thus, a little more than half of the GPs can be regarded as being (somewhat) motivated, based on their attitudes, social norms, and perceived behavioral control. But the remaining GPs can be regarded as not motivated. About 60% perceived difficulties referring patients to lifestyle interventions and only 28% considered briefly in all patient contacts whether their patients were eligible for such interventions. While eighty-one percent of GPs indicated that they had the possibility to refer, 52% regularly referred patients to a lifestyle intervention in the last year. The multiple linear regression analysis with the Entry method showed that in the end-model three beliefs were still significantly related to 'considering referral': 'A lifestyle intervention leads to more sustained lifestyle changes' (β= .228; p= .032); 'In my direct environment changing lifestyle receives a lot of attention' (β= .248; p= .032); 'I do not want to disrupt my relationship with a patient by starting to talk about lifestyle changes' (β= --.208; p= .047). 'Actual referral' was significantly related to two beliefs: 'I am not able to refer my patients to a lifestyle program' (β= -.32; p= .003); 'In my direct environment changing lifestyle receives a lot of attention' (β= -.36; p= .001). With the Stepwise method, the same beliefs were significantly related to 'considering referral' and 'actual referral' (Table 3).

Beliefs related to referral behavior: It was tested whether the behaviors 'considering referral' and 'actual referral' were related (Pearson correlation, p <.05) to the 19 lifestyle intervention-related beliefs (Table 2). A lower probability to consider referral and actual referral was significantly (p <.01) related to a lower ability of GPs to refer (r= .23; r= .45, resp.). Talking more with colleagues about lifestyle interventions was significantly (p <.01) related to consider referral and actual referral (r= .28; r= .36, resp.), and the GPs' peer group higher attention to lifestyle interventions (r= .42; r .55, resp.) was also significantly (p <.01) related to consider referral and actual referral. In addition, consider referral in all patient contacts was related to more actual referrals (r= .37).

Table 2: Relation between GPs' lifestyle intervention-related beliefs and their referral behavior towards lifestyle interventions

Lifestyle intervention related beliefs	% Agree	% Neutral	% Don't agree	M	Consider referral	Actual referral
Primary care should not have to deal with lifestyle influences.	9	5	85	4	-.12	-.13
A lifestyle intervention will ensure that care consumption costs decrease.	55	29	15	2	.13	.06
A lifestyle intervention will ensure that healthier behaviors can be better maintained.	76	16	7	2	.22*	.11
A lifestyle intervention yields more than it costs.	68	26	5	2	-.06	.04
A lifestyle intervention costs a patient more energy than it produces.	8	18	73	4	-.04	-.12
A lifestyle intervention will eventually cost more money than it yields.	13	30	56	4	-.04	-.04
It is not the responsibility of a general practitioner to have patients adopt a healthier lifestyle.	20	27	52	4	-.23*	-.08
One lifestyle is made better durably by adopting a lifestyle intervention.	47	37	14	3	34**	.16
I find it easy to refer patients to a lifestyle intervention.	18	21	60	4	.12	.27**
I'm not sure if I make the topic of lifestyle known with my patient.	12	9	78	4	-.19	-.17
I am supported by my immediate colleagues in my actions to promote lifestyle interventions.	61	31	7	2	.22*	.21*
I am not able to refer my patients to a lifestyle program.	8	15	76	4	-.23*	-.45**
I frequently discuss lifestyle influencing with colleagues.	48	26	24	3	28**	36**
In my direct environment lifestyle influencing receives a lot of attention.	53	26	20	2	.42**	.55**
I do not want to disrupt my relationship with a patient by starting to talk about lifestyle improvements.	0	9	90	4	-.14	.08
I have no time to busy myself with the lifestyle of my patients.	13	14	72	4	-.10	-.18
In all the patients that I see I consider (briefly) whether they are eligible for a lifestyle intervention.	28	20	52	4	--	.37**
In the past year I have regularly referred patients to a lifestyle intervention.	52	19	28	2	.37**	--

* $p < .05$ (2-tailed) , ** $p < .01$ (2-tailed)

Table 3: Stepwise multilevel analysis regressed on GP's beliefs as predictors of referral

	Model for considering referral	Beta	R Square
1	In my direct environment lifestyle influencing receives a lot of attention	.424**	.180
2	In my direct environment lifestyle influencing receives a lot of attention	.364**	.244
	One lifestyle is made better durably by adopting a lifestyle intervention	.261*	
3	In my direct environment lifestyle influencing receives a lot of attention	.367**	.286
	One lifestyle is made better durably by adopting a lifestyle intervention	.292*	
	I do not want to disrupt my relationship with a patient by starting to talk about lifestyle improvements	-.206*	
	Model actual referral		
1	In my direct environment lifestyle influencing receives a lot of attention	.554**	.307
2	In my direct environment lifestyle influencing receives a lot of attention	.453**	.373
	I am not able to refer my patients to a lifestyle program	-.299**	

* p < .05; ** p < .01

GPs' own lifestyle related to referral behaviors: It was tested whether five GP beliefs regarding their own lifestyle were related (Pearson correlation, $p < .05$) to 'considering referral' and 'actually referring' (Table 4). A higher probability in 'actually referring' was significantly related to GPs' self-report of physical activity ($r = .21$; $p < .05$), how important GPs' found their own physical activity level ($r = .33$; $p < .01$), and to how important they found having a healthy diet themselves ($r = .23$; $p < .05$). GPs' own lifestyle factors were not significantly related to 'considering referral' of patients to lifestyle interventions.

Table 4: Relation between GPs' own lifestyle beliefs and their referral behavior towards lifestyle interventions

GP's lifestyle factors	Consider referral	Actual referral
How do you evaluate your own physical activity?	.05	.21*
How important is physical activity to you?	.18	.33**
How do you evaluate your own diet?	.03	.07
How important is a healthy diet to you?	.05	.23*
How do you evaluate your own weight?	-.06	-.03

* p < .05 (2-tailed); ** p < .01 (2-tailed)

Patient indicators in referring patients to lifestyle interventions

Three methods to explore patient indicators in GPs' referral behavior concerning lifestyle interventions were applied: rating imposed patient indicators, case-based referring, and assembling spontaneously suggested decisive patient indicators.

In the first method, GPs were asked to indicate the importance of nine presented patient indicators in their referral behavior, and to indicate the most eligible group for a lifestyle intervention. Lifestyle interventions were thought to be most eligible for natives (98%) and strongly motivated patients (88%). Level of physical activity (85%) and diet (79%) were also important (Table 5).

Table 5: Percentage of GPs who find an indicator important in referrals, and most eligible groups for referral to lifestyle interventions

Indicator for referral	% important	Most eligible group	% important
Gender	2	No difference	50
		Men	50
Language	43	Native speakers	100
Ethnicity	99	Natives	98
Age	35	Younger than age 65	69
Educational level	30	Lower educated	62
Motivation	98	Strongly motivated	88
Medical fitness	71	Medically suitable	84
Physical activity level	85	Inactive in the past	48
Diet	79	Unhealthy eating habits in the past	65

In the second method GPs were presented with eight patient cases that varied in age, educational level and presence of physical complaints. For older patients (age >70) and patients with physical complaints, GPs were inclined significantly more often to consider referral, to consider the patient as more eligible, and to actually refer the patient more often. With respect to educational level, lower-educated patients were referred significantly more often to a lifestyle intervention than higher-educated patients (Table 6).

Table 6: Percentage of GPs referring a patient to a lifestyle intervention, with a low/high age, low/high educational level and yes/no complaints.

	Age		Education		Complaints	
	low	high	low	high	yes	no
Consider referral	2.745	2.975*	2.760	2.760	3.126	2.593*
Patient eligible	3.157	3.283*	3.210	3.230	3.381	3.058*
Referred	2.573	2.795*	2.745	2.624*	2.907	2.462*

* $p < .05$

In the third method, spontaneously suggested decisive patient indicators for referral were assessed using an open coding indexing technique (Table 7).

Table 7: Patient indicators to refer or not to refer to a lifestyle intervention (% GPs mentioned)

Indicators to refer	
Physical disorders (e.g. overweight, DM, COPD, heart failure)	90
Health risk	66
Patient is motivated for a lifestyle change	27
Patient needs counseling in a changing lifestyle	11
Lifestyle intervention is facilitated	9
Psychosocial complaints	6
Indicators not to refer	
Patient is not motivated for a lifestyle change	79
Physical disorders (e.g. heart failure, infectious disease, osteoarthritis, anorexia, limited mobility)	12
No health risk	10
No appropriate lifestyle intervention is facilitated	11
Psychosocial/cognitive disorders	4
Patient does not fit in a lifestyle intervention (e.g. age, ethnicity)	4

DISCUSSION

GPs' motivation to refer to lifestyle interventions

Although the majority of GPs was motivated for lifestyle interventions, in a substantial group GPs within our sample perceptions on lifestyle interventions and referring to lifestyle interventions were not positive. GPs' refer behavior seemed significantly related to their perceived subjective norm and perceived behavioral control toward referral to lifestyle interventions. This may partly explain why not even one-third of them briefly considered each patient for referral to lifestyle interventions during patient contacts, and barely half of the GPs referred patients to lifestyle interventions regularly. Our results are consistent with the outcomes of Ampt[13] and Kim[21], who showed that attitudes, social norms and control beliefs were key elements in GPs referral behavior. We demonstrated that specific social norm and attitude beliefs were predictors of 'considering referral' (18 to 29% of the variance) and specific social norm and self-efficacy beliefs predicted 'actual referral' (31 to 37% of the variance). These outcomes were comparable with the results of a review (including 185 studies) showing that the TPB variables accounted for 27% in the variance of behavior[22]. This suggested that our measurements reflect the state-of-the-art.

While the TPB is one of the most common theories in investigations of the relationship between cognitions and behavior, our operationalization of the TPB can be considered as limited. To improve our model of referral behavior, firstly, the conceptualization of the TPB could be improved by a more detailed analysis according to the 'two-component' model of the

TPB[23-26]. In this version of the TPB, a distinction is made between: instrumental and affective attitudes[27], two components of perceived social pressure: injunctive and descriptive norms[27], and two dimensions of perceived behavioral control: self-efficacy and controllability[23]. Secondly, a goal perspective on the referral behavior could be used to further understand it: GPs can set "considering and actual referring" as professional goals and engage in self-regulation strategies to safe-guard these goals when goal-barriers are encountered. With more insight into GPs' self-regulation regarding referral, based on control theories[28,29], we may further improve their knowledge and skills to cope with barriers to referral.

Additionally, we showed that GPs referral behavior was associated with GPs' perceived importance of their self-reported physical activity behavior and dietary habits. It may be that GPs use personal perceptions about their own health also as the basis for referring patients for lifestyle interventions or not. In addition, GPs own values and health behaviors may influence patients through their perceived social norms and through modelling[30]. Little is known yet about the influence of personal variables of GPs on their professional functioning.

For a better referral in practice, up-to-date information about evidence based interventions should be available which may lead to a more positive attitude in GPs. Strategies should be developed to increase the transfer and uptake of health-related lifestyle information for GPs that may not have the tools or resources to do this independently. Therefore, tailored Web resources should be applied, through a forum, for professional guidance and the availability of state-of-the-art PA information. In Canada such a resource has been employed with success, where GPs make use of the Physical Activity Line[31]. To perceive effective social support, more attention should be given to lifestyle interventions by national professional associations for GPs.

Providing a formal procedure for referring may influence positively GP's perceived behavioral control. Person's study (2013)[32] already indicated that, in lifestyle matters, doctors indicated a need for cooperation with other health care staff because of a lack of procedure and guidelines. For a more effective lifestyle management we recommend a greater integration of allied healthcare professionals with GPs in clinical practice as in the Physical Activity Line[31].

Patient indicators in referring patients to lifestyle interventions

Most decisive patient indicators for referral to lifestyle interventions were somatic risk factors, which concords with the study of Lawlor[33] where almost all of GPs only focused on complaints to initiate follow-up services. Apparently, GPs use health risks from somatic guidelines for chronic diseases, which suits curation well but may be less relevant for prevention.

The perception of patient's motivation to work on lifestyle changes was another important factor in their decision whether to refer or not: Using the present methodology, unmotivated patients were not referred to lifestyle interventions by the majority of GPs, in line with Kim's study (2015)[14]. However, there are no shared guidelines for GPs in primary care to estimate patients' motivation, and most GPs are not trained to assess this motivation. Moreover, when low motivation is used as a contraindication for referral to a lifestyle intervention this means that large groups of people may be discarded.

Socio-demographic factors, such as age, educational level and ethnicity, were also used by GPs in the referral process. When explicitly asked about age, GPs indicate a preference to refer younger patients to lifestyle interventions, but when age was embedded in patient cases older patients were referred more often. This result illustrates the complexity of assessing the decision-making process to approach what happens in practice. Moreover, the reasons why GPs use sociodemographics in their decisions concerning lifestyle interventions remain unknown. All in all, this decision-making process needs more study.

To make a proper assessment, based on more than just somatic states, there should be an improvement in assessment of patients' motivation as well as in the use of *shared* decision-making for referral to lifestyle interventions. A tool should be provided to: 1) identify patient's motivation; 2) provide information about eligible interventions for apparently non-motivated people 3;) indicate which patients are eligible for referral, and; 4) provide information about eligible programs for specific groups in the vicinity (e.g. age-groups, ethnicity-groups). In line with Rubio-Valeria's study, the skills required (i.e. assessment of motivation and communication skills) should be trained in the education of health professionals, in which a transition is needed from a biomedical to a biopsychosocial model of care[10]. This might also reinforce the professionals' self-confidence to engage in shared decision making regarding lifestyle, and it could help GPs to decrease their subjective influences in the implementation of their profession.

Limitations

This study had some relevant limitations. The identification of 'considering referral' and 'actually referring' relied on self-reported single questions. The validity of measuring both behaviors using single-item measures might be questioned. Also, the order in which Likert-scales where used may have influenced the GPs' responses: The answer order was reversed in some questions. Furthermore, the sample of GPs may not be representative of the total population of Dutch GPs. From the invited GPs, only 12.4% provided data and relatively many female GPs responded, and the sample differed on gender, type of practice and working status. Previous UK research has suggested that female doctors may be more involved in preventive general practice,[34] which might have influenced our results.

Although we have to be careful with generalizations based on this particular sample, this study does provide insight into the GPs motivation and decision-making in referral to lifestyle interventions in primary care. The shown variance among GPs in motivation to refer to lifestyle interventions and the associations that were found between referral behavior and decision-making might still be of value for the general population of GPs. At the least this study was able to address some important issues among GPs that may inspire further research and guideline development concerning preventive practices.

Conclusion

To conclude, a substantial group of GPs was not motivated for referral to lifestyle interventions. Their motivation and referral behavior might be improved by providing them with information about evidence based lifestyle interventions information about lifestyle interventions, with social support from professional organizations, and with official guidelines for a more objective and systematic screening of patients.

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CHAPTER 8
GENERAL DISCUSSION

In the current thesis a theory-based counseling method is developed to implement an effective and sustainable active lifestyle in primary care patients with a-specific complaints. Barrier beliefs (BBs) about physical activity (PA) were explored and a BB counseling intervention (BBCI) was tested in a primary health care settings. Suggestions are made to improve referral patterns to lifestyle interventions in order to support the effectiveness of implementation in primary care.

Barrier beliefs about PA (BB)

In **chapter 2, 3, 4** we described that barriers are not factual realities that inhibit PA, but thoughts or verbalized experiences of a person about obstructing factors regarding PA, approached from a social cognitive perspective. As these beliefs integrate the concept of barriers into the Social Cognitive Theory[1], they are called *barrier beliefs* (BBs). BBs are attributions: They are the diagnosis of a person why a goal cannot be accomplished, determined by negative self-efficacy beliefs and negative outcome expectations. Based on our developed theoretical framework, in **chapter 3** data showed that the ranking of the most expressed types of BBs in people self-determined as active or inactive, were the same, although more inactive people expressed BBs to PA. Thus, the same types of BBs in inactive people, may cause relapse from PA in actives.

Real barriers or excuses

Although BBs are conceptualized as a personal "diagnosis" of the causes why a PA goal is or might not be accomplished, BBs may also be used as "excuses" to legitimize not being active: People may mentally construct reasons why they do not engage in PA. Excuses may indicate a dissonance between how active a person *wants* to be and how active he or she *should* be from personal perspective or from the perspective of others (PA standards or social norms). Excuses may be recognized in a context when a person's motivation to invest in PA is so low that he or she cannot afford the requested investment to perform PA, and therewith *denies* his / her motivation as being low.

In practice, when BBs are in the function of dissonance reduction, they will be resistant for change strategies and the causes of inactivity may continue to resist. Excuses can be revealed by targeting the BBs with all four BB strategies, consecutively: If the BBs resist, they might be identified as excuses. In order to decrease dissonance, the first goal for unmotivated people to engage in PA should be to guide new positive experiences about PA with minimal levels of tailored exercise. Therefore, the urgency to use excuses for not being active may decrease, causing an emergence of real BBs with new experiences performing PA.

A challenge in further research will be to measure BBs with an "excuse-like" character. They may be identified by assessing their correlation to validated "disengagement beliefs". For instance, adult smokers, who are highly resistant to quit smoking and continue despite their knowledge of the negative effects of it, use rationalizations or justifications for continuing smoking, which are referred to as disengagement beliefs[2,3]. Disengagement beliefs about sustained PA should be further researched in order to investigate barrier-excuses for not being physically active.

Intervening on BBs

In **chapter 4,** a cognitive theory on motivation and relapse was described in order to stimulate PA and prevent relapse. A theory-based BB approach is described for primary care with four BB strategies, consisting of: change the means to reach goals, set (different) goals, restructure beliefs, induce acceptance. The implementation of this client-tailored BB counseling intervention is described in **chapter 5 and 6.** In **chapter 5** the effects of a BBCI on PA and diet were analyzed. An 18-month multicenter randomized controlled trial was conducted with an intervention group (BBCI; N=113) and a standardized lifestyle intervention group (SLI; N=91), in thirteen general practitioner practices in the north of the Netherlands, in primary care patients (aged 18-70), self-determined as 'inactive'. Outcomes on physical activity were measured at 6, 12 and 18 months. Although the contrast found between the BBCI and the SLI was small, and the latter intervention also had its effects, the added value of the BBCI, compared to the SLI, was that it further improved PA behavior in the longer term, and possibly prevented for relapse. Additionally, it effectively decreased expressed BBs to PA on the longer term. Moreover, a decrease in specific BBs was related to an increase in specific PA outcomes and quality of life (**chapter 6**). Therefore, the BBCI had more long-term effects on PA and quality of life compared to the SLI.

Referral to lifestyle interventions in health care

Referral to lifestyle interventions is not broadly applied so far[4]. To enlarge the effectiveness of motivation and decision-making in referrals to lifestyle interventions within primary health care, we suggested that tailored web resources should be available (**chapter 7**). Such resources should, firstly, contain health-related lifestyle information for general practitioners. Secondly, it should provide tools for an objective assessment of patients' motivation and BBs to change lifestyle. Thirdly, updated information should be presented about refer options within the region, possibly differentiated by subgroups.

There have been websites applied for professional guidance for general practitioners. For instance, in Canada such web resources have been employed successfully: General practitioners make use of qualified exercise professionals through the Physical Activity Line[5] to enhance the transfer of information to general practitioners[6]. Additionally, a Dutch example of primary health care support, is of an addiction treatment organization[7] that informs general practitioners how to handle with addiction professionally. It contains information about how to recognize addiction, gives referral options, informs about treatments, and provides tools to measure motivation and addiction. Through this website, also consultation, training and supervision is offered to general practitioners. Making available such information about lifestyle interventions for general practitioners, who may not have the tools or resources to do this independently, might reinforce the shared decision-making of the general practitioners. Moreover, it could help general practitioners to decrease their subjective influences in the decision-making process, regarding lifestyle interventions.

For an effective lifestyle management, we recommend a cooperation of allied healthcare professionals with general practitioners in clinical practice. While general practitioners have limited time to modify behaviors that is not directly related to a disease, they should consider systematically whether a patient is eligible for referral to a lifestyle intervention. The task of the general practitioner should be to detect a lifestyle problem, to warn the patient for health consequences of an unhealthy lifestyle, and to refer to the healthcare professional within general practice. Thus, health professionals could inform patients about health related lifestyle information, treat them or refer to tailored lifestyle interventions within the region.

If the majority of the approximately twelve thousand general practitioners' practices in the Netherlands would refer eligible patients for lifestyle interventions, this might have a substantial impact on public health. In Western societies people visit their doctors frequently[8]. It may lead to a change in the social norm by increasing the amount of leisure time PA done in a society where more than 40% is insufficiently active. Besides primary health care, also secondary health care may be eligible for lifestyle promotion, in order to contribute to the effect of medical treatments, to improve health and to prevent illness.

Clinical relevance

Participants of the BBCI added on average 4 minutes per day to their moderate-to-vigorous PA, and sedentary behavior decreased with 15 minutes per day. To compare, in the SLI participants' moderate-to-vigorous PA decreased on average with 5 minutes per day and sedentary behavior increased with 15 minutes per day. However, improvements, caused by the BBCI, had only small to very small effect sizes. An explanation may be that the participants were already active at the beginning of the intervention, and also, the BBCI did not impose to a certain amount of exercise time. It focused on setting mini-goals, adapted to patient's motivation, and released commonly used PA standards.

There is evidence that breaking up prolonged sedentary behavior is of major importance for health[9]. Additionally, in a cohort study of Wen et al. (2011), a minimum amount of 15 minutes moderate-to-vigorous PA per day (similar to 105 min per week) was sufficient to reduce mortality[10]. Research already showed that benefits of PA can be reached in less than 30 minutes PA/day[11-15]. Besides, it might be of bigger socio-economic importance that many people change a little than few people change much. Therefore, a release of commonly used PA standards[16] is recommended for lifestyle counselors in the individual counseling of inactive people, to increase the chances of exercise adherence.

The found contrast between the BBCI and the SLI was small because effects of the SLI on the short term also were to be expected[17-23]. Our results however showed that adding a BBs strategy could further improve PA in lifestyle interventions in the longer term and might prevent relapse. More research is needed for refining strategies of the BBCI in order to increase effectiveness on PA.

Changing diet

No differences were found between intervention-groups on diet. With our data it was not possible to draw conclusions about the efficacy of the BBCI on a diet change. We aimed to measure a change in dietary behavior by assessing frequency and portion of snacks, fruit and vegetables and frequency of main meals on an average per week. Measuring servings in portion at a time and number of days per week is a commonly used format[24,25]. However, validity of measuring diet behavior with a total score may be criticized (**chapter 6**). Different entities were taken together to compose a total score to measure diet behavior: frequency of main meals per week was taken together with the intake of snacks, vegetable and fruit per week. The diet measurement may be improved by dividing outcomes of frequency of main meals from intake of snacks, vegetable and fruit.

Moreover, the complexity of changing diet may have had its influence on the efficacy of the BBCI. According to Dijksta (2018), a behavioral change involves two components: 1) overcoming the loss of functions of unhealthy behaviors (e.g., overeating) and 2) the investment in performing new tasks of healthy behaviors (e.g., eating more vegetables)[25]. These components, which induce inhibiting beliefs, cause people to stick to their unhealthy behavior. In changing diet, the loss of function of the old behavior will be directly associated to the performance of the new behavior. That is probably not the case in increasing PA. The behavior for which PA is replaced, could be performed at another moment. It may not be necessary to give up the function of the old behavior (e.g., watching TV).

The present conceptualization of BBs may seem unique to PA. However, BBs as a cognitive mechanisms are possibly at play in behavior change in many health behaviors. Table 1 shows an example of the application of the four BB strategies on goal related BBs in changing diet: a decrease in calorie-intake and an increase of vegetables and fruit consumption. Yet, the BBCI may also be applicable to many other lifestyle behaviors.

The therapist-effect

Almost every psychotherapy study addresses, either directly or indirectly, the role of therapist characteristics in affecting therapeutic change. Empirical research suggests that aspects of the therapist's contributions are among the most influential in facilitating outcomes[8]. Research shows that overall therapeutic experience in conducting therapy, is strongest related to outcomes, whereas age, gender, gender match, and experience with conducting the specific techniques are not[26]. In this thesis the BBCI and the SLI were performed by 25 counselors (**chapter 5 and 6**), all initially unexperienced in conducting therapy and trained to participate in both interventions. Twenty-one of the 25 counsellors were the same in both interventions. Four counselors only participated in the BBCI, treating in total 9 participants. This number of counselors, implementing both intervention-groups, may give a reasonable and comparable variance in therapist-characteristics in both groups.

Table 1: Application of the four barrier-belief strategies of the barrier-belief counseling intervention on two formulated lifestyle goals.

Barrier-belief strategies	**Changing means strategy:** -Support to stick to the goal -Change strategies to reach the goal	**Goalsetting strategy:** -Support to change the goal into a goal with no/small BBs	**Restructuring strategy:** -Support to stick to the goal -Cognitively change BBs	**Accepting strategy:** -Support to take the investments and costs in order to reaching the goal
Goal: "Increase of daily Pa: My daily PA will increase with 20 min/day by cycling to my work"				
Goal related barrier belief	I find it difficult to cycle every day to my work to increase my PA	An increase of 20 min of my daily PA is too difficult for me	It is no use to try to increase my daily PA again, I already failed so many times	I suffer from the negative thoughts about myself related to the performance of PA
Action plan	I will cycle 2 times/ week to my work for 20 minutes, and the other days I will walk during the evening for 20 minutes to be active for at least 20 min each day	I will increase my daily PA with 10 min/day by walking every evening	Because my skills to perform PA are trained, I am able to perform my goal related PA tasks	Because I learned to observe with distance and 'let go' the negative thoughts about myself performing PA, I am able to exercise without suffering from it
Goal: "Increase of fruit intake per day: I will eat two pieces of fruit each day"				
Goal related barrier belief	I don't like to eat fruit	Eating two pieces of fruit is too much for me	I don't think that eating fruit has any positive effects on my health	I do not really enjoy eating fruit in general
Action plan	I will eat extra vegetables to get enough vitamins each day	I will eat one piece of fruit each day	Because I now have the knowledge about the positive health effects of eating fruit I am more motivated to eat fruit each day	Because I weighed the value of the positive health effects of eating fruit against the value of the disappointing taste of fruits, I learned to neutrally experience the effects of fruit.

Factors affecting the outcomes

Still, in the present study it is complex to allocate the precise causes of the outcomes. For instance, participating in interventions causes not only intervention effects but also effects caused by other factors than the intervention. External characteristics (age, gender, ethnicity and socio economic status) as well as internal characteristics (personality, well-being, attitudes and values) all affect the outcomes within a person[27]. The impact of these factors, however, have been intended to minimize by the randomization.

Also, there was a difference between the BB counseling group and the SLI in the way the intervention was implemented (individual vs group) and the frequency of sessions, although the total contact time was about the same. Additionally, both interventions (BBCI and SLI) included different behavioral chance techniques, each of which may have had its own influence.

Both interventions existed of 'general' behavioral change techniques (e.g.: 'social support', 'goals and planning', 'feedback and monitoring', etc.)[28], which were in both interventions the same. There were also strategy 'intervention-specific' behavioral change techniques (e.g.: 'comparison of behavior' in the SLI and 'barrier identification' in the BBCI), which were not the same in both interventions. This makes it complex to pinpoint the exact source of the efficacy of the interventions on behavior. Issues such as these can be systematically explored in modeling experiments where elements of an intervention are manipulated.

Future research

We conducted a *treatment package strategy*, wherein two different treatment 'packages' were compared to a non-treated control group: the BBCI and the SLI, combined with a *comparative treatment strategy,* wherein the two treatment packages were compared to each other: the BBCI and the SLI. Future research may elaborate different methodological strategies on the BBCI in order to determine the exact source of efficacy to maximize the impact of the BBCI. This can be analyzed through two different methodological strategies[27]: Firstly, the BBCI could be analyzed by a *dismantling strategy*, consisting of analyzing the components of the given package. A difference between intervention-groups is made by elimination of one of the four BB change strategy from the 'package'. Secondly, the BBCI could be analyzed by *constructive treatment strategy*, referring to developing a treatment package. A difference between intervention-groups is made by adding BB change strategies from the 'package' that may enhance outcomes. Thirdly, a *parametric treatment strategy* could be conducted. Behavioral change techniques within the existing BBCI are altered to find the optimal variation, to refine a particular technique within each strategy. Variations between groups are made by presenting more or less of a given technique. Thus, the next step would be to further investigate the efficacy of different elements within the BBCI on health behaviors to maximize the intervention-impact and to refine strategies.

Limitations

There are some limitations with regard to the trial. Firstly, while in the RCT both interventions were recruited from general practice offices and from the community at large, the non-treated hanging control group was only recruited from the community at large. Possibly because of this difference in recruiting, there were significant baseline differences on BMI and activity level between the control group and the intervention groups. Consequently, analyses were controlled for BMI and PA baseline measures. Secondly, because of difficulties in recruiting, the number of participants of the control group was smaller than in both intervention groups. Thirdly, both intervention groups were follow-up at 6, 12 and 18 months, while the control groups was only followed up at 6 months. These differences between the control group and both intervention groups make it discussable to compare outcomes between subjects of control group and intervention groups. No significant changes were found within subjects in the non-treated control group on the outcomes, except on diet, with a very small increase.

Furthermore, we cannot avoid the impression that general practitioners relative frequently referred "deviant" patients to the RCT. Frequently patients were referred who had already undergone many interventions and of whom the general practitioners and allied health professionals did no longer knew how to treat lifestyle. For instance, people with a low education, extreme obesity, several lifestyle disorders, a cognitive disability, an immigrant background or from disadvantaged neighborhoods. Therefore, outcomes cannot be generalized to a general population. The present study concerned people with a-specific complaints, a difficult population to stimulate in PA, and a population which is eligible for lifestyle changes. Further research should provide data obtained on samples from a wider base, or specified on target groups, such as elderly, sedentary patients or specific patient groups.

Additionally, the average amount of moderate-to-vigorous PA of study participants in the RCT, determined with the accelerometer, was quite high with 33 min per day (min 3; max 88; SD 20): A substantial group of participants in both interventions was fairly active at the start of the intervention. A reason may be that no objective PA measurement was used as cut-off point for eligibility-screening. Eligible participants were self-determined as 'inactive'**.** Eligible participants came in contact with the study after the general practitioner invited them to join the study or in response to the invitation letter. Thereafter a counselor contacted them by phone and verbally checked inclusion and exclusion criteria for eligibility in all participants. Only highly active participants were excluded than, i.e. when they reported being moderately active, >100 min/day. Patients, recruited by the general practitioner, turned out to be motivated to PA, and may have started PA before baseline. We suggested that unmotivated people are referred less often by general practitioners (**chapter 7**). The same could have applied to people who volunteered to join the study. Thus, an objective PA measure should be used as cut-off point in the screening of participants, in order to provide data about changing PA in inactive people.

In assessing BBs, it is likely that not all BBs were covered by our survey (**chapter 3**) and in the qualitative studies (**chapter 2 and 3**). There may have been barriers beyond the counselor's scope, which could have played a significant role in goal-abandonment. Moreover, we did not measure the validity of the counsellors' estimation of true barriers (instead of excuses), the participants' awareness of its own perceptions and the participants' ability to speak about perceptions. There is a chance that the counselor made an incomplete inventory of BBs or missed crucial barriers. We tried to prevent an incomplete or incorrect assessment by controlling the counseling sessions with protocols of measuring BBs. Prior to implementation of the interventions, all counselors followed a training consisting of 10 two-hour sessions and a practical exam, followed by weekly peer group session, supervised by two trained lecturers/researchers. Additionally, the participating counselors were asked to audiotape their first two sessions (after the intake) with their clients in which they investigated the BBs. This allowed the researchers to monitor the quality of the BB assessments. In general the counselors seemed to be sufficiently able to explore endorsed BBs in clients. The training and supervision sessions seemed to be sufficient to assess BBs. Therefore, education to counselors (knowledge- and skills training) is needed to further improve BB assessments.

Context of the BB approach

This thesis mainly focuses on the individual cognitive determinants of behavioral change. From the perspective of the BB approach, changing behavior is an individual and cognitive process of learning, and aims to independently sustain the healthy behaviors for the rest of a person's life. The (re)discovering of the personal options in a physical and social environment with its consequences (investment needed and expected outcomes) were crucial in the counseling process. Bandura already postulated with the Social Cognitive Theory[1], upon which this BB approach is based, that individuals are able to adapt their behavior to deal with the external environment.

BBs of an individual give insight into his / her environment: BBs provide a diagnosis of factors that exist in the physical and social environment, where the person cannot easily deal with. Because a person has only limited influence on the environment, our idea about sustained behavioral change is not that the environment should be changed to achieve certain behavior, but the person should change by learning to handle with his / her environment. Changing behavior is about adjusting the goals or adjusting perceptions about the performance of a goal, adapted to the person's environment. This is the evolutionary way of adaptation, to deal with environmental pressures. Adaptation can be the development of a new behavioral strategy, as well the loss of an old one, as long as it pays-off. For a maximum efficacy, individual interventions should go hand in hand with health interventions on physical and social environment, such as the construction of playgrounds in a city, or community based exercise projects in neighborhoods.

To our opinion, the responsibility for healthy behaviors should be placed within the individual: The individual is responsible for the choices he / she makes in performing specific behavior, for investing in a behavioral change (let go old behaviors and learn to perform new behaviors), and for the consequences of his / her behavior. Yet, it would be rather improper to make a person on its own responsible for its health behavior, while the behavior is also depending on environmental factors[29-31,32]. Sometimes people have little or no influence on their environment, for instance, on rules and regulations, or the design of the public space in their neighborhood. Authorities could make people's healthy behavior easier by facilitating means to eliminate inhibiting environmental factors. This could help people to find their way to behave healthy in their environment. Therewith the needed investment to perform the desired behavior decreases and a lasting behavioral change will be more likely. If public health is considered as important, there should be placed a responsibility at a higher level: Health care, insurers and the government could support, enhance and sustain health behaviors for society.

The current Dutch government and the health care system demonstrated that they support preventive care. Policy issues about nutrition, health protection and prevention are on the agenda of the Ministry of public health, wellbeing and sports, aimed at promoting and protecting the health of the citizens[33]. However, health care for instance, seems not very arranged to provide preventive lifestyle services[4,34-38]. In contrast, health care professionals themselves seem to find prevention important[26], and it's principles receive social support[39,40]. To make treating lifestyle common practice, knowledge about implementation strategies and the efficacy of lifestyle

interventions should be disseminated. Additionally, the parties that influence people's living environment should be involved to continue efforts of improving health. In future research, factors should be explored influencing the referral, the implementation and the effectiveness of lifestyle interventions. Additionally, a role division should be made among stakeholders and required knowledge and tools for implementation should be inventoried. Specifically, the infrastructure should be analyzed to effectively implement PA interventions in different settings and populations, causing that health care, insurers and the government could play their role in facilitating health behaviors in society.

Conclusions

In the BBCI, barriers to PA were approached as *beliefs* that obstruct the pursuance of a PA goal. These *barrier beliefs* (BBs), as social cognitive determinants of PA, refer to people's mental representations of the causes of not initiating PA or relapse into inactivity. People carry numerous BBs to PA participation. Four different theory-based strategies were developed intervening on BBs to PA. The value of the BB approach was that it further improved PA behavior and quality of life in the longer term, compared to the usual care, and possibly prevents for relapse. Unique of this approach is that participants are skilled in self-management concerning PA by learning to set goals, detect BBs, and handle BBs using (one of) the four BB strategies. Importantly, a cognitive mechanism about BBs to PA are possibly at play in behavior change in many health behaviors.

In this thesis, a release of commonly used PA standards is advocated in counseling individuals to increase the chances of exercise adherence: Barriers are reduced with goals, tailored to a personal situation. A small amount of exercise can be easier to achieve, due to the limited investment. If an easily manageable amount of exercise is recommended, people might be more easily motivated to exercise. Also, once an individual does a small doses of daily exercise regularly and experiences positive outcomes, they might be more likely to increase the amount of time they spend exercising per day. Although stimulation of the pursuit of PA standards could be an effective message for the community at large, as soon as the opportunity arises to coach people individually, PA goals should be tailored to the person.

We argued that behavioral change is an individual and cognitive process. To our opinion, people themselves are responsible for their behavior. Through individual interventions people may learn to cope with the different options to perform health behaviors in their physical and social environment, which should be further researched and stimulated in the future. While people's behavior is also partly depending on environmental factors, authorities should support, enhance and sustain a healthy physical and social environment for the largest impact.

Because lifestyle becomes increasingly important in society and healthcare, and a growing group of people needs coaching with their lifestyle behaviors, lifestyle professionals should learn to psychologically guide people's behavior. To be capable of doing more than technically advise clients in exercise, lifestyle professionals should be educated with up-to-date knowledge and professional skills on behavioral change, and equipped with tools and tailored resources

for implementation. In this study, a professional education (10 two-hour sessions and a practical exam) and an intervention manual in the BB approach were developed and can be used instantly in e.g., post HBO education for health care professionals, social workers or lifestyle coaches. Also, lifestyle interventions itself should contain evidence-based social cognitive mechanisms for a more effective implementation in practice. Change strategies, such as a BBCI, may be useful in interventions to target inactivity and relapse. Therefore, BB change strategies could be useful in, or added to PA counseling, for those experiencing or expressing BBs. Although our BB approach was tested in primary health care settings, its principles may be applicable in all kinds of interventions, such as community based interventions, applications through the Internet, group educational programs, mass media interventions, etcetera.

We hope this thesis innovates practice with knowledge about BBs in changing lifestyle, and inspires to effectively change behaviors by incorporating the BB method as an effective element.

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APPENDICES

SUMMARY

Engaging in regular physical activity and eating a healthy daily diet are both associated with many physical and mental benefits. However, in Western societies, a substantial part of the population is not sufficiently active and fails to meet the recommendations of a healthy diet. Lifestyle counseling programs seem an appropriate channel for lifestyle promotion in health care. Research has shown that physical activity interventions can lead to higher levels of physical activity, but many people do not engage in physical activity sufficiently, and do not use these interventions. Additionally, the research outcomes on the efficacy of physical activity interventions are highly variable, and finding. Effective ways to maintain improvements over the longer term still is a challenge. There is a need for understanding inactivity and relapse from physical activity, and for theory-based behavior change strategies to facilitate long-term physical activity.

In research, it is agreed that focusing on barriers may be a key factor for facilitating long-term physical activity. Several studies have described barriers related to physical activities, although a grounded theory is lacking. In **chapter 2** a qualitative research was conducted to identify barriers inhibiting physical activity, during counseling, among inactive people (N=24). The aim of this study was twofold: to investigate which barriers related to their physical activity people experience during the first phase of lifestyle counseling, and to construct a grounded theory to develop a clustered barrier model related to physical activity. A grounded theory was constructed with different types of barriers related to physical activity. This theory seemed useful for further research and for coaching practice to systematically explore barriers.

In **chapter 3** a quantitative research was conducted to identify barriers to physical activity from a social cognitive perspective. The aim of this study was twofold. Firstly, a theory based measurement of barrier beliefs on physical activity was developed. Secondly, endorsed barrier beliefs in active and inactive people were explored. Additionally, a difference in endorsement of barrier beliefs between active and inactive people was measured. A literature search, a qualitative study and expert-meetings were conducted to develop a barrier-beliefs survey. A cross-sectional study was performed with the developed survey assessing: barrier beliefs, intention, perceived pros and behavioral control and leisure time physical activity, in active and inactive people (N=266, aged 18-80). The internal reliability and the validity of the barrier-beliefs survey were analyzed. Data provided a validation of all scales, which were shown to be internally consistent. The ranking of the most expressed barrier beliefs in active and inactive participants were the same, although significantly more inactive participants endorsed barrier beliefs to physical activity. This study developed a social cognitive framework of barriers related to physical activity in active and inactive people. Findings contributed to a theory-based measurement of barrier beliefs about physical activity and gives insight in causes of physical inactivity and relapse.

Barrier-belief change strategies were developed **in chapter 4.** The aim of the study was to describe a cognitive theory on motivation and relapse in order to stimulate physical activity and prevent relapse, and to explain how different types of barrier beliefs play their role in increasing sustainable lifestyle changes. Social cognitive theories and empirical evidence were evaluated for developing a theoretical framework and counseling strategies. This study provided a set of cognitive and behavioral strategy for practice, aimed at preventing the occurrence of barrier beliefs to physical activity. The barrier-belief approach is a way of counseling to stimulate engagement in physical activity, which can also be used instantly in the counseling of health care practice for healthy people and patients, to facilitate long term physical activity.

In **chapter 5** the effects of a barrier-belief counseling intervention (BBCI) on physical activity and diet behavior were analyzed. An 18-month multicenter randomized controlled trial was conducted with an intervention group (BBCI; N=113) and a standardized lifestyle intervention group (SLI; N=91), in thirteen general practitioner practices in the north of the Netherlands, in primary care patients (aged 18-70), who were 'inactive' and willing to sign up for a physical activity intervention. Physical activity (accelerometer and SQUASH), and diet (self-report of food servings) were the main outcomes which were measured at baseline and at 6, 12 and 18 months, and analyzed using a multiple regression analysis. The BBCI was more effective in stimulating physical activity compared to the SLI ($p<.05$): On the short term all physical activity outcomes improved ($p<.05$), on the long term moderate to vigorous physical activity outcomes improved ($p<.05$), all with small effect sizes. No differences between interventions were found on diet behavior. The BBCI in primary care improved physical activity compared to the SLI. The patient-tailored barrier-belief approach seemed promising for implementation in practice to increase long term physical activity.

In **Chapter 6** firstly, the effects of a barrier-belief counseling intervention on existing physical activity inhibiting barrier beliefs were investigated. Secondly, the impact of a change in barrier beliefs on physical activity and quality of life was analyzed. The data were derived from the multicenter randomized controlled trial described above. Barrier beliefs (assessed with the 62-item barrier-beliefs survey), physical activity (accelerometer and SQUASH questionnaire) and quality of life (EORTC QLQ-C30; LASA; Cantril's Ladder) were measured at baseline and at 6, 12 and 18 months. Intervention effects on barrier beliefs were analyzed using multiple regression analyses, and the impact of changes in barrier beliefs on changes in physical activity and quality of life were assessed with multilevel analyses. The barrier-belief counseling intervention was more effective in decreasing barrier beliefs compared to the SLI. Multilevel regression analyses suggested mediation: A decrease in specific types of barrier beliefs was related to an increase of different outcomes of physical activity and quality of life. Lowering specific types of barrier beliefs seemed to contribute to an increase of physical activity behavior on the longer term, and quality of life. The BBCI was more effective than the SLI in decreasing barrier beliefs, which in turn increased physical activity and quality of life ($p<.01$). The barrier beliefs change strategies can be provided in the counseling of physical activity to those who experience barrier beliefs.

In **chapter 7** we aimed to explore firstly, GPs´ motivation to refer to lifestyle interventions and to investigate the association between GPs' own lifestyle-behaviors and their referral behavior. Secondly, information was gathered on patient indicators in the decision-making process of the GPs' referral to lifestyle interventions. GPs' referral behaviors were assessed, considering referral and self-reported actual referral, and their own lifestyle behaviors (physical activity, diet, being overweight). Decision-making regarding referring patients to lifestyle interventions was assessed by imposed patient indicators, spontaneously suggested decisive patient indicators, and by case-based referring (vignettes). To this end, a cross-sectional study was conducted among 99 Dutch primary care general practitioners. A substantial group of general practitioners was not motivated for referral to lifestyle interventions. General practitioners' refer behavior was significantly associated with their perceived subjective norm, behavioral control, and their own physical activity and diet behavior. Furthermore, patient indicators in referral to lifestyle interventions were patients' somatic states, and patients' presumed motivation for lifestyle interventions. General practitioners motivation and referral behavior might be improved by providing them with tailored websites applied for professional guidance primary health care, with support from allied health professionals, and with official guidelines for a more objective and systematic screening of patients.

Conclusions

In the barrier-belief counseling intervention barriers to physical activity were approached as *beliefs* that obstruct the pursuance of a physical activity goal. We call these beliefs *barrier beliefs*. These barrier beliefs, as social cognitive determinants of physical activity, refer to people's mental representations of the causes of not initiating physical activity or relapse from physical activity. Patients in primary health care settings expressed numerous barrier beliefs concerning physical activity. We showed that barrier beliefs inhibited the participation in physical activities. Lowering specific types of barrier beliefs appeared to contributed to increased physical activity behavior and an improved quality of life, in the longer term.

Change strategies, such as used in the BBCI, may be useful in lifestyle interventions to facilitate long term physical activity for those experiencing barrier beliefs. Although we have to be careful in generalizing trial findings to the general population, the added value of the barrier-belief approach, compared to the SLI (which can be seen as usual care), was that it further improved physical activity behavior in the longer term, and possibly prevented for relapse.

Barrier beliefs as a cognitive mechanism influencing physical activity are possibly at play in behavior change in many other health behaviors. Moreover, the barrier-belief approach may not only be used to improve health behaviors through individual counseling; its principles may be adapted to other types of interventions, such as internet applications or educational group programs in different settings (e.g., in schools). Detected barrier beliefs may guide the design of means and goals in physical activity and other health behavior interventions.

To improve general practitioners motivation and referrals to lifestyle interventions, firstly, official guidelines for screening eligible patients are recommended. Secondly, web resources with tools and information about lifestyle programs can be provided within primary health care

in the Netherlands. Thirdly, the implementation of lifestyle interventions should be supported by allied health care professionals. In the end, broadly providing effective evidence-based interventions for physical activity stimulation has the potential to contribute to an increase in life expectancy and quality of life in all societal segments.

SAMENVATTING

Regelmatig bewegen en het hebben van een gezond voedingspatroon hebben een bewezen relatie met de fysieke en mentale gezondheid. In de westerse samenleving voldoet echter een aanzienlijk deel van de bevolking niet aan de richtlijnen van een gezonde leefstijl. Er is behoefte aan meer inzicht in de oorzaken van inactiviteit en aan gedragsveranderingsstrategieën om het beweeggedrag van inactieve volwassenen op de langere termijn effectief te verbeteren. Het doel van dit proefschrift is een verandermethode te ontwikkelen voor het stimuleren van bewegen voor de eerstelijnszorg. Daarvoor zijn er barrière overtuigingen geïdentificeerd die het beweeggedrag van zowel inactieve als actieve mensen belemmeren. Vervolgens hebben we een theorie geschreven over het werkingsmechanisme van verschillende typen barrières en zijn er verschillende veranderstrategieën ontwikkeld om barrière overtuigingen te doen afnemen. De effecten van deze 'barrière-methode' op barrière overtuigingen, beweeggedrag, voedingsgedrag en de kwaliteit van leven zijn onderzocht bij 'inactieve' eerstelijnszorgpatiënten. Zowel inactieve als actieve mensen bleken tal van barrière-overtuigingen bij bewegen te ervaren. De resultaten van ons onderzoek tonen aan dat, in vergelijking met de 'usual care' binnen de eerstelijnszorg, de barrière-methode effectiever is in het doen afnemen van barrière-overtuigingen en het doen toenemen van bewegen en de kwaliteit van leven op langere termijn. De in dit proefschrift beschreven psychologische mechanismen spelen mogelijk ook een rol bij gedragsverandering van andere leefstijlgedragingen. De beschreven principes kunnen ook worden toegepast binnen andere soorten interventies, zoals in apps of community-based interventies.

Daarnaast is de motivatie van Nederlandse huisartsen om te verwijzen naar leefstijlinterventies onderzocht en zijn patiëntindicatoren in het besluitvormingsproces bij het doorverwijzen in kaart gebracht. Om de motivatie van huisartsen en verwijzingen naar leefstijlinterventies te verbeteren, worden in dit proefschrift aanbevelingen gedaan voor de eerstelijnsszorg in Nederland zoals het ontwikkelen van een tool voor verwijzingen, het vergroten van kennis en het ontwikkelen van vaardigheden om leefstijl gedrag van patiënten te beïnvloeden. Ook zou de implementatie van leefstijlinterventies moeten worden ondersteund door speciaal opgeleide leefstijl professionals in de zorg. Uiteindelijk kan het bieden van effectieve evidence-based interventies voor het stimuleren van bewegen in potentie bijdragen aan een toename van de levensverwachting en de kwaliteit van leven in alle maatschappelijke segmenten.

DANKWOORD

Dit proefschrift heeft een lange weg afgelegd. Na te zijn gepubliceerd door een aantal wetenschappelijke tijdschriften heeft onze nieuwe methode van gedragsverandering geprofiteerd van internationale aandacht. Maar het onderliggende plan dateert van veel eerder. Het begon als onderzoeksvoorstel, om onderzoek te doen naar de effectiviteit van beweeginterventies. Al snel kwam ik in contact met Arie, die de conceptuele basis heeft gelegd van deze nieuwe methode. Na vele gesprekken kwamen we erachter dat we de code wilden kraken van wat mensen tegenhoudt om te gaan bewegen. We begonnen met het interpreteren van psychologische theorieën van gedrag, bewegen en barrières. We gingen mensen ondervragen en een instrument maken om barrières te meten. We ontwikkelden een nieuwe counseling methode, schreven een handboek voor het coachen van barrières, gaven scholing over de methode aan studenten en, om deze nieuwe methode te testen, zetten we programma's op binnen huisartsenpraktijken in Groningen, Friesland en Drenthe. Verschillende mensen hebben me hierin enorm gesteund, me veel geleerd, bekritiseerd en aangespoord om de lat steeds hoger te leggen. Bijzondere vermelding verdienen:

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♡ ♡ ♡

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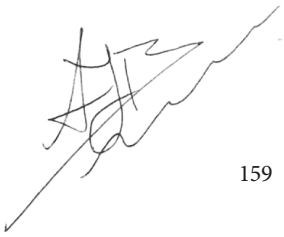

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Bouma, A. J., van Wilgen, P., Lemmink, K. A., Stewart, R., Dijkstra, A. & Diercks, R. L. Barrier-belief lifestyle counseling in primary care: a randomized controlled trial of efficacy. Augustus 2017. Padua, Italy.

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